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Learning style discrimination between vocational and non-vocational students.

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LEARNING STYLE DISCRIMINATION BETWEEN VOCATIONAL AND NON-VOCATIONAL STUDENTS

A Dissertation Presented
by
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DEDICATION

To the Public School Educators of

Franklin County, Masssachusetts

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ABSTRACT

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VOCATIONAL AND NON VOCATIONAL STUDENTS

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The purpose of this study was to determine if there was any significant difference between the learning style of those students who chose to attend a vocational school and those students who remained in the comprehensive school system.

The test population was all the ninth grade students in public schools in Franklin County, Massachusetts. This included six comprehensive high schools with a combined test sample of 550 and one vocational school with a test population of 78.

The Learning Style Inventory developed by Dunn, Dunn, and Price was used to determine the learning style of the students tested. A stepwise descriminant analysis as well as descriptive analysis was performed.

The stepwise discriminant analysis found that vocational students were significantly different in twelve of the twenty-two subscales tested. The results from the discriminant analysis indicate that the vocational students wanted more of a quiet environment, they wanted low light and cooler temperatures. They were not as conforming or responsible and they wanted authority figures present. They did not like to learn in several different ways, including sometimes learning alone, sometimes with peers, or sometimes with authority figures present. They did not want to learn through their tactile or kinesthetic senses. They preferred to learn in the evening rather than in the early morning or late morning, and they were less parent motivated and more teacher motivated than their non-vocational counterparts.

The descriptive analysis demonstrated that for five of the subscales (Noise Level, Light, Temperature, Design,and Late Morning), the style which would best meet,or at least have no adverse effect on, the needs of the greatest number of non-vocational students would benefit or be neutral to the least number of vocational students.

(Key Words: Learning Style, Learning Style Inventory, Vocational Education, Technical Education)

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CHAPTER I

INTRODUCTION

This chapter will introduce the dissertation, identify the central problem, and state the purpose and significance of the problem.

Introduction

In the past few years, Massachusetts vocational-technical educators have been called on to meet a wide range of student needs. The implementation of Massachusetts Chapter 766 and Unites States Public Law 94-142 mandated Massachusetts vocational-technical schools to provide services to special education students, a population which vocational-technical schools may not have fully served in the past. Vocational-technical schools at one time had a larger pool of candidates from which to select students, and are now confronted with students having a variety of learning problems. The candidate pool has been further narrowed by declining enrollment

throughout the secondary school age population. Furthermore, with the passing of Massachusetts General Laws, Chapter 188, vocational-technical students must measure up to given academic criteria. In the Massachusetts vocational-technical schools, the time allocated to academic subjects is half that as in the comprehensive schools, to allow for the earning of both trade certificates and high school diplomas.

To further compound the difficulties of the vocational-technical school, the trades themselves are becoming more complex. A technological revolution has hit all the trade areas, and vocational-technical instructors must ready their students for these new challenges. Otherwise, students may find themselves prepared only for dead end jobs as hypothesized in the Carnegie Report on American Education.(1)

A partial answer to the difficulties presented by changing needs for adequate student preparation may be found in the theory of learning style and its incorporation into curriculum development. The idea that different students learn in different ways is not new to educational thought.(2)(3) At the very least, the idea has been part of the "mythology" of vocational-technical education, as evidenced by the thought, "If a student isn't good with

his head, send him to a trade school where he can use his hands." In the late 1960's more definitive research on learning style was begun, yet its practical use in the classroom was little discussed until the 80's.

There has been some work on putting the theory of learning styles into everyday use in the classroom. However, little attention has been specifically paid to vocational-technical applications. Learning style theory appears to offer potential benefits to students in vocational-technical education.

Statement of the Problem

Vocational-technical education in Massachusetts is a discrete portion of schooling serving a population of students segregated from the mainstream of high school education. According to the Commonwealth of Massachusetts Board of Education,

> Vocational education is a discrete and important component of occupational education. It usually occurs after grade seven, preparing students to seek, acquire and succeed in a specific trade, technical or occupational field requiring specialized or technical skills for entry into that field.(4)

Vocational education in Massachusetts may be divided into

the following subject areas: distributive occupations, industrial, agricultural, vocational home economics, and allied health professions.(5)

One of the major distinctions between vocational-technical education and other secondary education is in their respective purposes. Massachusetts Department of Education Chapter 74 regulations state that "the major goal of vocational-technical education is to prepare students to seek, acquire and succeed in a specific trade, technical or occupational field requiring technical skills for entry into that field."(6)

A second major difference is the organization of the school day. The following schedule is required by the Commonwealth of Massachusetts:

> A full time program shall include not less than the number of hours in a school day as established by the Board of Education. For vocational programs in all occupational areas, laboratory, shop and work experience instruction shall comprise one-half the length of time of the school day uninterrupted, or the equivalent thereof...Related and academic instruction shall comprise at least one-half the length of time of the school day or the equivalent thereof; provided, however, that the academic instruction shall comprise at least one-quarter the length of time of this school day or the equivalent thereof.(7)

The student who typically seeks a vocational-technical education also differs from his counterpart in the comprehensive school. These differences may also present unique problems for vocational educators.

In Massachusetts, the percentage of white, non-Hispanic students for the total school age population is 87 percent; for vocational-technical schools this percentage is 95 percent.(8) This information, however, may be somewhat misleading since it was impossible to get accurate figures for equal populations: The total population figures cited above are for students in grades K-12, whereas the information for vocational-technical schools is for grades 9-12. The difference in percentages may reflect the high drop-out rate of minority students at the secondary level. Nationwide, minority students make up 24 percent of the enrollment in vocational-technical education. This is four percent higher then the number of minority school-age individuals in the general population.(9) However, a study performed under the supervision of John Goodlad in Ohio found the following: Generally, it seems that "the sample of multi-racial/ethnic vocational-technical classes is too small and schools too diverse for much generalizing about the allocation of students from various racial and ethnic groups to vocational-technical education programs in general."(10)

Based upon the divergence in statistics and the statement above, it appears that although some conclusions may be drawn about the racial composition in a particular vocational-technical school, no overall generalization concerning the racial composition of all Massachusetts vocational-technical students is possible from the data available.

In Massachusetts, 69 percent of the students enrolled in vocational-technical schools are male while the total school age population is 51 percent male.(11) (See Table 1)

TABLE 1

COMMONWEALTH OF MASSACHUSETTS GRADE 9-12 ENROLLMENT

	Males	Females
Total School-Age Population	51%	49%
Vocational Students	69%	31%

Throughout the United States, the number of female students involved in vocational-technical education is 51.6 percent.(12) One major factor which may account for the low percentage of female students in Massachusetts is that clerical training there is not considered part of vocational-technical education, whereas in most states and as far as Federal statutes are concerned this is a vocational-technical program.

Evans and Galloway's study found that students in vocational-technical programs were generally of lower socio-economic status than students not taking vocational-technical courses.(13) A national study reported that 30 percent of vocational-technical education students come from the lowest socio-economic group.(14)

In Massachusetts, a higher percentage of vocational-technical students participate in the Federal Free Lunch Program than do students in comprehensive high schools. It therefore appears that vocational-technical students in Massachusetts tend to come from lower income families.

Nationwide, between two and three percent of the vocational-technical school population is classified as handicapped.(15)(16) In Massachusetts, eighteen percent of vocational-technical students are classified as special needs students, as compared to fifteen percent of the entire school age population. The discrepancy may be caused by differences in definitions of a "handicapping condition." The factors considered to constitute a "handicapping condition" appear to vary greatly from one school to another.(17)

Nationally, the mean reading and math scores of high school seniors in vocational-technical education are significantly lower than those of college-bound

seniors.(18) In Massachusetts, the trend for lower scores seems to be borne out by the results of the Basic Skills Testing Program.(19) (See Table 2) Massachusetts vocational students scored lower than non-vocational students in every area tested.

Table 2

1983-1984 ANNUAL REPORT ON BASIC SKILLS
PERCENT PASSING STANDARD

	Reading	Writing	Mathematics
Non-Vocational Students	91%	90%	90%
Vocational Students	84%	77%	76%

Since the major goal of vocational-technical schools is to prepare students for the workplace, one would expect vocational-technical students to be more "job" oriented than their non-vocational-technical counterparts. The National Longitudinal Study of the High School Class of 1962 found that most vocational-technical graduates felt that their preparation was important in landing their first jobs. Furthermore, vocational students found their education more relevant in terms of expectations than did students in other curricula, and they seemed more satisfied with their education than graduates from other curricula.(20) Although the cited class graduated over 25

years ago and some changes in education have since occurred, the study is still important.

One study (that admittedly used a sample size casting doubt on its validity) makes the following conclusions about the attitudes of vocational, as opposed to other, students:

> Vocational school students felt that adults do not trust youth; they placed less importance on education; they held the family in lower esteem and depended less on relationships with family members; and home life was placed relatively low in importance. Vocational school students were, however, more inclined to believe that careers were possible without post-secondary education.(21)

The foregoing factors suggest that vocational-technical schools differ in many important ways from comprehensive schools. Despite this, instructional methods and curricula tend to be the same in both settings, at least as far as the academic components of each are concerned. Vocational-technical teachers are not differently trained; the same textbooks are used; the structure of classrooms is similar. Based on the vocational-technical schools' uniqueness, however, it is reasonable to suppose that learning could be enhanced by the use of methods and curricula that acknowledge the differences rather than denying them.

Statement of the Purpose

As the preceding section demonstrates, vocational-technical education in the Commonwealth of Massachusetts is unique due to its structure, goals, expectations, and population served. Because of these factors, which distinguish vocational education from other types of secondary education in Massachusetts, it seems reasonable to suggest that optimum instructional methodologies will differ from those commonly employed in comprehensive schools.

This study hypothesizes that the uniqueness of Massachusetts vocational-technical schools is reflected in the learning style preferences (as hereinafter defined) of those students who elect the vocational alternative; and that vocational-technical classroom teachers can utilize knowledge of the learning style preferences of their students by practical means in order to optimize learning in ways that may differ from "mainstream" comprehensive school methods and curricula. The purpose of this study was to evaluate the learning styles of similar student populations, one of which has elected to go to a vocational-technical high school and one of which has opted to remain at the academic high school.

Endnotes

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CHAPTER II

REVIEW OF THE LITERATURE

This chapter examines various learning style theories with particular emphasis on the Dunn and Dunn model. It also surveys research on student learning styles and their implications.

Literature Search

As can be seen in the discussion of different learning style theories that follows, there are many models that attempt to explain the phenomena of learning style. All of them, however, are based on a definition of learning style as an expression of an individual's preference for certain sets of conditions under which optimum learning occurs. Within different models, causes, preferences and sets of conditions are defined in different ways.

Canfield and Lafferty

The Canfield and Lafferty model(1) allows for the development of curricular materials for an entire class or for an individual student based on the results of the Learning Style Inventory, a thirty question, self-reporting

instrument. This test can be used for students in grades seven through adult.

Canfield and Lafferty believe that learning style is derived from a number of conditions such as the relationship with the teacher, the student's peers and the learner; the organization and structure of the learning environment; the preferred method by which the student learns, i.e., listening, reading, etc.; the goals and expectations set for the learner; and the competition within the class. This model places heavy emphasis on the affective domain.

Gregoric

The Gregoric learning style model(2) is delineated by two continua: concrete-abstract and random-sequential. Learners are placed into four group; concrete random, concrete sequential, abstract random or abstract sequential. In this model it is possible to exhibit more than one style.

The instrument used is a self-reporting instrument comprised of four words in ten sets. The recommended use is for grades nine to adult. (An instrument for lower grade levels is currently being developed.)

In Gregoric's model, emphasis is placed on matching the curricular material to the learning style of the learner. Gregoric recommends that work be done in areas

where the student has not exhibited a preference in order to strengthen that area.

Hill

Hill's Cognitive Style Inventory(3) is a self-reporting instrument measuring abstractions, visual, tactile and auditory perceptions, motor coordination, and social interaction. Hill believes that cognitive style is the way an individual searches for meaning. This is shown by the way qualitative and theoretical symbols are handled; the cultural influences affecting the meaning given to symbols; and the meaning that the learner gives to perceived symbols.

By using the Cognitive Style Inventory (grades elementary to adult), a cognitive map can be created identifying the student's strengths and weaknesses. It assists in developing a personalized educational program using a variety of instructional techniques to match the student's individual learning style to the educational objectives to be accomplished.

Hunt

The Hunt model(4) uses two instruments to judge the educational conditions under which the student is most likely to learn. The first of these, Teacher Assessment of Student Learning Style, is a teacher observation based on the student's reaction to systematic, teacher-introduced

changes in structure. The second, Paragraph Completion Method (PCM), is an instrument where students write responses to a posed topic. This is a semi-projective method assessing conceptual level. It can be used with grades six through adult. Hunt believes academic achievement is facilitated by matching the educational approaches to the student's learning style. He further believes that the conceptual level is a developmental phenomenon ranging from the "initialized" to the "independent". Hunt believes that a knowledge of the student's style can influence the development of his conceptual level. In this model, heavy emphasis is placed on the amount of structure the learner requires.(4)

Kolb

Kolb (5) believes that learning style is a result of heredity, past experiences and present conditions. These three factors affect the four basic learning styles he hypothesizes; concrete experience (feeling), reflective observation (watching), abstract conceptualizing (thinking) and active experimentation (doing). Kolb places heavy emphasis on the individual's personal awareness of his style and the alternative methods he can use to achieve educational objectives. In this model, teachers are encouraged to develop material that not only meets the

preferences expressed by the individual, but also strengthens weak areas.

The Learning Style Inventory is used to diagnose learning style as described by Kolb. This is a self-reporting instrument based on a rank ordering of four possible words in each of nine different sets. Each word in the set represents one of the four categories Kolb believes represents a learning style. This test is designed for older adolescents to young adults.

Ramirez and Castaneda

In this model(6), identification of cognitive style is used to match and to mismatch learning and teaching style. The goal is to encourage the learner not to favor one style over another. Ramirez and Castaneda believe that learning style is not permanently fixed, and can be changed. They further believe that cognitive style differences and cultural differences create an individual's learning style.

To find the learning style, as postulated by Ramirez and Castaneda, a direct observation checklist (Child Rating Form) is used by the teacher, yielding frequency of behavior scales. Ages kindergarten through adult can be rated on this scale.

Schmeck, Ribich and Ramaniah

The Inventory of Learning Processes is used to measure learning style in the Schmeck, Ribich and Ramaniah model.(7) This test is a sixty-two item true/false self-report inventory grouped by factor analysis into synthesis-analysis study methods, fact retention and elaborative processing. Schmeck et al. believe that learning style is the product of a group of information processing activities that the learner prefers to use when challenged with a learning task. They place this on a continuum from shallow-repetitive-reiterative to deep-elaborative. Schmeck et al. believe that it is the instructor's duty to encourage students to develop a deep-elaborative learning style through the use of specific instructional strategies.

Dunn and Dunn

One model which many researchers have accepted and which I will discuss in much greater detail than those previously described was developed by Rita and Kenneth Dunn. The Dunn Model is based on the following hypotheses:

> That elements of learning style included in the model are educationally significant;
> That students can identify their own learning styles;
> That learning styles are stable over time and are consistent across disciplines; and
> That teaching students through their learning styles leads to increased academic achievement.(8)

In the Dunn model, the sets of conditions are broken down into five major groups; environmental, emotional, sociological, physical and psychological. Each of these major groups are further divided into a series of elements.

Environmental factors affecting learning are sound, temperature, light and surroundings. Learners who are sensitive to various environmental factors may be affected by them in differing ways. Some learners like, even need, background noise, while others find silence more conducive to learning. Tropical temperatures inspire learning in some individuals; others find them soporific. Some individuals find that high-intensity lighting induces hyperactivity. For some, a comfortable chair may hinder learning, while for others the opportunity to recline on a soft couch may aid the process of learning.

Motivation, persistence, responsibility and need for structure are subsumed under the heading of emotional aspects of learning style. As with all learning styles, each of these rather sweeping categories indicates a continuum, e.g., from low to high motivation.

Physical aspects of learning include the perceptual, which is concerned with kinesthetic, tactile, aural and visual learning. There is evidence that all learners are unwitting "specialists" in one (or sometimes more) of these

styles; that each prefers to learn, and learns better, when provided with learning opportunities in his favored style. Another factor is intake - the phenomenon that some learn more easily while smoking, drinking, eating, or chewing gum. Different times of the day are preferred by different individuals for learning. More learning takes place when these preferences are given attention.(9)

Psychological elements include global/analytic, hemispheric preference, and impulsive versus reflective factors. Learners who are analytic learn best through step by step processes, where global students must first see the "big picture" before being able to synthesize information. Hemispheric preference (right brained or left-brained) is a relatively newly-explored element. The last element is reflective versus impulsive. This refers to the individual who quickly responds to a question as compared to the individual who contemplates before answering.(10)

Not all students are affected by each of these elements, and some are affected to varying degrees. Obviously, different styles of educational material and presentation will lend themselves to different styles of learning.(11)(12)(13)

The following is a description of the elements of learning style in the Dunn and Dunn Model:

ENVIRONMENTAL

Sound:	The individual need for either quiet or sound when learning.
Light:	The amount of light which an individual will tolerate.
Temperature:	The temperature at which an individual will learn best.
Design:	The individual's need to study in a formal (i.e., classroom) or informal (i.e., bed) environment for optimal learning.

EMOTIONAL

Motivation:	The individual desire to learn the task (material).
Persistence:	The individual's inclination to complete tasks or to take breaks and possibly return to the task.
Responsibility:	The individual's desire to conform to what is expected.
Structure:	The individual's need for specific direction or latitude to learn best.

SOCIOLOGICAL

Peer oriented:	The individual learns best with/from peers.
Self:	The individual learns best alone.
Pair:	The individual learns best with one other person.
Team:	The individual learns best when working on a team to achieve a particular goal.
Adult:	The individual learns best with an authority figure.
Varied:	The individual learns best using different sociological groupings.

PHYSICAL

Perception

Auditory:	The individual learns best by hearing information.
Visual:	The individual learns best by seeing or reading information.
Tactile:	The individual learns best by touching and feeling.
Kinesthetic:	The individual learns best by

	doing or performing.
Intake:	The individual needs to nibble, smoke, drink etc. to learn best.
Time of Day:	The time of day during which the individual learns best.
Mobility:	The individual needs to move about to learn best.
PSYCHOLOGICAL	
Global:	The individual needs to see material as a whole to learn best.
Analytic:	The individual needs to see all of the whole to learn best.
Hemispheric Preference:	The individual preference or cerebral dominance.
Impulsive/ Reflective:	The individual response to new learning problems or questions.

Why Use Learning Style Theory?

The obvious question for the educator-practitioner is why he should be aware of or utilize information concerning learning styles. The research shows academic gains by students whose learning styles are understood and allowed within the learning process. According to Dunn, Dunn, and Price(14), "In experiments conducted where students were permitted to study in ways that were harmonious with their learning styles, academic achievement and retention were invariably increased." Furthermore, the authors suggest that using learning style information is a possible way teachers can show that they "have made every effort to determine how individuals learn. Prescriptions developed

on the basis of individual diagnosis verify that teachers are being as professional as possible in their efforts to assist their students. Neither the public, the courts, the legislators, nor our students could expect more."(15)

It should also be noted that there is evidence that this technique may have applications outside the classroom. "When the counseling intervention is compatible with selected elements of the student's learning style, counseling goals are achieved to a significantly greater extent than when intervention is incompatible with learning style."(16)

In a study reported in 1971, Farr(17) found that, although only 20 percent of students sampled preferred an auditory learning style, 90 percent of all instruction was offered to these students via lecture. Students who were taught and tested in their preferred learning style performed significantly better than those who were taught without reference to their stylistic preferences. Even when instructors were informed of these findings, they persisted in their adherence to an auditory style of presentation.

A study by Estell Crino(18) on kindergarten students concluded that the match between most students' learning style and the curriculum was non-existent. This may

support the theory put forward by Dunn and Carbo(19) that many students do not learn, not because they lack ability, but because they are not being taught in a way that meets their needs. They conclude by saying, "No single method can reduce the risks of reading failure for all children. A sensitive and sensible variety of methods is the best way to improve the odds that reading can be a winning game for everyone."

A 1985 article in the Reading Teacher(20) strongly points out the effects of lighting on learning and gives evidence of increased learning when learners are matched with their light preference. Similar findings are reported in the popular press. In February of 1981 the Reader's Digest(21) carried an article on lighting and its effects on the performance and attitudes of individuals.

David Cavanaugh(22), a high school principal in Ohio, reported that implementation of a diagnostic-prescriptive approach using learning style has not only improved academic skills but also caused a marked improvement in student attitude.

Vocational-technical education and learning style

In the most extensive study available which focuses on learning style in vocational-technical education,

researchers found that students at Fox Valley Technical Institute (Wisconsin) selected programs that complemented their learning styles.(23) Other studies, notably Domino's(24) and Dunn's(25), have found that students perform better when they self-select, or have selected, programs offering instruction in their preferred learning style. The inference is that, given the opportunity, students will choose programs that reward them by enabling them to perform better; and that learning style is a factor in better performance and learner satisfaction. Vocational-technical schools probably offer more choice in this area than do most comprehensive schools.

Fox Valley students also indicated a concern with a low-high structure continuum. The study showed they felt most effective in learning situations mixing structured and unstructured styles. Most vocational-technical students did emphasize a preference for some structure in their schooling.(26)(27) This finding agrees with a survey conducted at Franklin County Technical School(28) which asked students why they had applied to a vocational-technical school and why they remained there. Replies indicated that, for over 80 percent of the respondents, the openness of the shop situation was a major factor in

keeping students at the school. Yet most students also indicated that they wanted assigned tasks clearly defined in terms of desired end achievement. There is some indication here that vocational-technical students actually select the vocational school over the non-vocational school, or at least remain there, not so much out of the desire for a particular trade career as from a learning style preference that may be more fully met at the vocational-technical school.

Vocational-technical students in the Fox Valley study exhibited a second learning style preference along a concrete-to-abstract continuum. Students favored concrete rather than abstract ideas, and they were more likely to work from facts to generalizations than they were to derive facts by using a theory.

Learning style seems to be a valid phenomenon. Existing data suggests that certain learning styles prevail among vocational-technical students, and that catering to preferred styles leads to increased learning and learner satisfaction -- results that are considered desirable by students, teachers, and school systems. It remains to study the feasibility of diagnosing learning style and implementing learning-style oriented programs in the classroom.

Diagnosing Learning Style and Classroom Implementation

The Fox Valley(29) results, as well as studies by Domino(30), show that students themselves will select courses complementing their learning styles if given the chance. This tendency to self-select practically eliminates the need for formal diagnosis, assuming that programs geared to various learning styles are available within the school and are accessible to all students.

Dunn, Dunn and Price(31) maintain, on the basis of a 1977 study, that teacher observation alone can lead to the identification of certain learning styles among students, notably perceptual aspects, light preference, and motivation by an adult. On the other hand, teachers were not able to identify self-motivation, persistence, need for formal design in surroundings, or sound preferences by observation. (Teachers had received some indoctrination on learning style from the researchers.)

More formally, a diagnostic instrument exists in the Learning Style Inventory(32), measuring four of Dunn's major categories (environmental, emotional, sociological, and physical) and subsets as described previously. For the Fox Valley study, Oen(33) and Banks(34) devised, tested and modified a Liekert-type scale (The Learning Activities

Questionnaire), which was used successfully by teachers to determine individual learning styles.

The diagnosis of individual learning style, via methods ranging from the casual to the formal, is a very real possibility. It can be accomplished in the classroom by the teacher. But of what value is this knowledge to the student and the teacher?

At Fox Valley, Oen(35) and Banks(36), by way of seeking a valid and practical mode of individualization, investigated the relationship between learning style and the process of individualizing curriculum in the vocational school. They came to believe that taking individual preferences in learning style into account is an important and feasible aspect of individualizing programs. As an outcome of his research, Oen felt that trained and committed teachers can be effective with individualized instruction techniques if they take an active part in developing curriculum and teaching materials; know what the desired ends are; base grades on predetermined criteria (note elements of structure for students and teachers); and use a variety of techniques and strategies in the classroom, including the provision of structure and extra help where needed. Successful individualized units should

contain performance objectives; provide various and adequate learning materials appropriate to students' ability level; and involve interaction of persons, procedures, and materials.(37)

In practical terms, it appears that virtually every program could be adapted to learning style preferences in the pursuit of individualization. This would be true even if such adaptation amounts only to ensuring that probable differences in learning style preferences are allowed for by the use of a variety of instructional methods, materials, and processes. Where possible, it may be worthwhile to allow students to select preferred activities.

Whatever the case, one inference is clear: successful program individualization in schools means more than allowing students to work "on their own" or at "their own pace." It means recognizing that different students learn differently. By providing a variety of learning opportunities, educators can avoid penalizing individuals.

Learning Style Inventory Findings

Research using the Dunns and Price's(38) Learning Style Inventory can be broken down into two major categories (for further information see Chart 1): Research done on particular populations to ascertain learning style differentials, and studies dealing with particular elements of style and their significance to learning.

The groups studied included gifted and talented, underachievers, truants and vocational students. The majority of the studies were of gifted and talented individuals. Those studies completed by Cody(39), Dunn and Price(40), Marcus(41), Ricca(42), and Vigna(43) discovered that gifted and talented students:

a. Have significantly different learning styles than their non-gifted counterparts;
b. Prefer a formal design and need a less strict environment;
c. Are more persistent;
d. Show less preference for auditory learning and prefer to learn through their tactile and kinesthetic senses;
e. Prefer learning alone;

f. Are teacher motivated; and

g. Are analytical rather than global.

Dunn, Price, Dunn and Saunders(44) found that students with low self-concept have a significantly different learning style than students with high self-concept.

Although there is only one study to date of vocational-technical students using the Dunn Learning Style Inventory, it appears that this population overall is significantly different from its non-vocational-technical counterpart(45).

The following 41 studies on matching learning style elements to instructional methods show appreciable gains in learning when the learning style of the student is matched with the teaching method. Individual findings are summarized below:

Researcher	Findings
Cafferty, Elsie	1. Students who had a better match with their teacher's style had the higher grades. 2. Students who had a lesser match with their teacher's style had lower grades.
Carbo, Marie	1. Kindergarten children taught through their strongest perceptual modality learned more easily and retained better than when taught through their weaker modality.
Cholakis, M. M.	1. Underachievers scored higher when an authority figure was present during the

	learning process. 2. In the learning of vocabulary, the underachievers whose preference was learning alone scored significantly higher.
Cody, Corrine, O'Connor	1. Verified the hypothesis that average, gifted, and highly gifted students had patterns of learning style significantly different from one another.
Copenhaven, Ronnie W.	1. Students' attitudes are more positive when students are matched to teachers who have a similar style. 2. Learning style of students remains consistent across subjects. 3. A wide range of learning styles exists in each class.
DeGregoris, C. N.	1. Students who showed a preference for sound showed a significant increase in reading comprehension when moderate talking was the underlying sound.
Della Valle, Joan	1. Students who showed a need for passivity and students who showed a need for mobility performed equally well when taught in environments designed for their particular style. 2. Neither the passive or active environment produced higher scores. 3. Students with a preference for mobility showed the most improvement when taught in an environment where they could be mobile.
Domino, George	1. Students taught in what they believed to be the way they learned best scored higher on fact, knowledge, attitudes and efficiency than those students taught in a way that they did not believe was effective for them.
Dunn, Rita S. & Price, Gary C.	1. Gifted students preferred a formal design. 2. Gifted students did not need structure. 3. Gifted students were less responsible than non-gifted students. 4. Gifted student were more persistent.

	5. Gifted students preferred to learn through tactile and kinesthetic senses. 6. Gifted student showed less preference for auditory learning.
Dunn, Rita Price, Gary C. Dunn, Kenneth Saunders, William	1. Students with low self-concept appear to require mobility, tolerate sound, prefer learning with adults, prefer a cool environment, and are not persistent or auditory learners. 2. Students with high self-concept prefer quiet, like to study in a warm temperature, are adult and teacher motivated, are persistent and prefer to learn in several ways.
Farr, Beatrice	1. Students predicted accurately the modality in which they would achieve best. 2 When students were taught and tested in their preferred learning style they did significantly better than when mismatched.
Giunta, Steven F.	1. Selected difference among learning style preference in diverse disciplines does not exist. 2. Instructors' learning style preferences were not related systematically to corresponding teaching style procedures, with the exception of sound and authority orientation. 3. As a predictor, the measured degree of match established neither an association with sequential grades in English, resultant reading comprehension scores, nor the level of stress.
Hodges, H.	1. Seventh and eighth graders matched to their design preferences did significantly better in learning mathematics concepts than those students who were mismatched. 2. Seventh and eighth grade students matched to their preference for design had a significantly better attitude toward the learning of mathematics than their unmatched counterparts.

Jarsonbeck, S.	1. Fourth grade students who had not performed well in mathematics did significantly better when matched with their auditory, visual, and tactile preferences.
Krimsky, Jeffrey	1. When matched with their light preferences, students showed significantly higher scores in the areas tested. 2. Mismatched students did more poorly in the areas tested than the matched students.
Kroon, D.	1. Industrial Arts students in the ninth and tenth grades did significantly better when matched with their perceptual styles in auditory, visual and tactile than their unmatched counterparts.
Lengel, Otto Vernon	1. The findings indicate some areas of learning style preference may be group traits - in particular the strong desire for adult praise and kinesthetic learning experience.
Lynch, Peter K.	1. Chronic truants attended school more frequently when matched for their time of day preference. 2. There was a significant interaction between the degree of truancy, learning style and English teacher assignment.
Marcus, Lee	1. Below average group showed a preference for mobility, preferred learning alone and was teacher motivated. 2 Average group showed a preference for formal design, was teacher motivated, and needed intake. 3. Above average students rated themselves persistent, teacher motivated, preferred learning alone, and needed intake. 4. Although there were some similarities across groups, groups showed overall a difference in learning style.
MacMurren, Harold	1. Students tested in an environment in which their preference for intake was

	matched achieved significantly higher mean reading speed, accuracy and attitude scores than when they were mismatched.
Martini M.	1. Seventh grade science students who were matched for their perceptual style in auditory, visual and tactile achieved better than students who were mismatched. 2. Students who were matched for the learning styles of auditory, visual and tactile had a better attitude toward science than those students who had been mismatched.
Miller, L. M.	1. Second grade students demonstrated an increase in the rate they learned to read when matched for their mobility preferences.
Miles, B.	1. Fifth and sixth graders who were matched for their sociological preferences scored significantly higher than those who were mismatched.
Morgan, Herbert LaMont	1. No significant difference emerged in student achievement between gifted students needing much structure and gifted students needing little structure when matched with their style. 2. Students did significantly better when matched than when mismatched.
Murrain, Peggy	1. Four times as many students preferred a warm rather than a cool environment. 2. Students tended to perform better when the environment matched their diagnosed temperature preference.
Murray, Elana Amelia	1. Low reading achievement students were unmotivated, needed high structure, and preferred to learn with adults. 2. There were learning style differences between males and females.
Pizzo, Jeanne	1. Students who were matched with their sound preference scored significantly higher reading and attitude scores than those students incongruent.

Price, Gary E., Dunn, Rita & Saunders, William	1. Students with high reading achievement preferred studying in a dimly lit, formal environment; were self-motivated, persistent and responsible; did not require intake; did not function best in the morning; did not require mobility; and did not prefer to learn through their tactile or kinesthetic senses. 2. Students with low reading achievement preferred a brightly lit, informal environment; were adult motivated; functioned best in the late morning; did not require mobility; and preferred learning through their tactile and kinesthetic senses.
Reca, Judith	1. Gifted students exhibited the following preferences: Independent study, responsible, adult, tactile, self-motivated, and learning alone. 2. Non-gifted students exhibited preferences in peer teaching, time-morning, high structure, auditory and visual learning, mobility, and learning with authority figure present. 3. Sex and ethnicity were found to be non-significant as to learning style.
Shea, Thomas	1. Significantly higher reading results were obtained when students were matched with their learning style preference for design. 2. Mismatched students who preferred a formal design were better able to adjust the environment to their needs than were the mismatched students who preferred an informal design.
Steinauer, Mary Helen	1. No learning style variable proved to be a good predictor of grades. 2. A noticeable pattern between certain learning style preferences and certain vocational programs existed.
Tappenden, Virginia Joanne	1. Vocational and non-vocational students differed significantly on 12 of the 21 learning style variables.

	2. Eleventh and twelfth grade students differed significantly on four learning style variables. 3. Rural students and urban students differed significantly on eight learning style variables. 4. Male students and female students differed significantly on thirteen learning style variables.
Tannebaum, Rhonda	1. Field independent students provided with low structure material performed better than their mismatched counterparts.
Trautman, Paul	1. Global students and analytical students achieved best when taught in their particular style. 2. There is no difference between the relative achievement of global and analytic students when taught in their preferred style.
Urbschat, Karen	1. Modality strength can be identified in first graders. 2. Significant results occurred when treatments were matched to learning style. 3. Most first graders found it easier to learn through visual or combined auditory/visual approaches.
Vigna, Ralph Angelo	1. Gifted students showed higher scores in analytic vs. global, authority figure present, visual, kinesthetic, and preferred late morning.
Virostko, J.	1. Students did significantly better in reading and mathematics when taught in their time preference. 2. In year two, the subjects were reversed and the same findings were revealed.
Weinberg, Frederick	1. Visual and tactile/kinesthetic under-achievers taught through their strongest perceptual modality achieved significantly better than when mismatched. 2. Auditory under-achievers learned significantly better when taught through their tactile/kinesthetic senses.

Wheeler, Roberta	1. Learning disabled students learned better when taught through their strongest modality than when taught through their weakest modality.
White, R.	1. A positive correlation exists between the Learning Style Inventory and the California Psychological Inventory sub-scale achievement on conformity. 2. Students identified as being consistent were also identified as manifesting conforming behavior. 3. Students who were high persistence and high responsibility performed significantly better in school than those who exhibited low persistence and low responsibility.
Wittenberg, Sandra Kay	1. Young adults in need of remediation have significantly different learning styles than young adults who do not need remediation. 2. Data suggested that, while race may be a determining factor of learning style, gender, socio-economic status and cerebral preference are not determining factors.

General Conclusions

The following are the major points identified by this literature search:

1. Learning style is an identifiable characteristic which, when diagnosed and prescribed for, can improve the achievement of the learner.

2. The Learning Style Inventory by Dunn, Dunn and Price(46) is able to identify an individual's style, allowing the instructor to identify the student's preferred method of learning.

3. Some research appears to show that various specific populations have learning styles that differ from the general population.

It would therefore be useful to further explore the concept of learning style to determine if vocational-technical students have a learning style differing from their non-vocational counterparts.

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CHAPTER III

METHODOLOGY

The following chapter presents the research hypothesis and the specific research questions that were asked. This study compared the learning styles of ninth-grade vocational-technical students with ninth-grade non-vocational students in Franklin County public schools. In addition, the chapter describes how the study was conducted, how the test was administered, the scoring procedures, and the statistical approach used to analyze the data. The limitations of the study are also given.

Population

The study population was ninth grade students in Franklin County public schools. This includes all six comprehensive high schools and the one vocational high school in the county. Seventy-eight vocational students and 550 comprehensive students took the Learning Style Inventory. (One vocational student's responses were incomplete, and that test was excluded from the analysis.) The sample represents virtually the entire ninth-grade public school population of the county. No

attempt was made to control the chronological age of the subjects.

Procedure

All seven schools gave permission for the administration of the Learning Style Inventory to all their ninth grade students. The Inventory was administered during English class. Only those students who were present on the day the Inventory was administered took the test. No attempt was made to follow up with the students who were absent at the time the Inventory was administered.

The results of this testing were returned to each of the individual schools. Since the test results are given for each student, the schools have the opportunity to use this knowledge to aid each student in achieving academic success.

For each of the Inventory's variables, group mean scores for the comprehensive high school students were compared to the group means for the vocational students in order to determine any differences in learning styles between the two groups. This analysis provides a descriptive comparison of the 550 non-vocational and seventy-seven vocational students tested.

In addition, Price Systems, Inc. performed a stepwise discriminant analysis to identify the learning style variables that significantly discriminated between vocational and non-vocational students. Because there was such a large difference in size between the two groups, it was felt that there was a risk of bias towards establishing "differences" that were actually the product of the overwhelming size of the non-vocational sample. To correct for any such risk, the tests of seventy-seven non-vocational students were randomly selected for use in the discriminant analysis by numbering all the non-vocational students' tests and matching their numbers with seventy-seven numbers randomly generated by computer from all numbers between one and 550.

Discriminant analysis is a multivariate statistical technique designed to compare two or more groups and their learning style variables. In this study, the technique was used to illustrate differences between the vocational and non-vocational samples' learning style preferences as assessed by the Learning Style Inventory. The stepwise discriminant analysis allows all independent variables to be held constant as they are analyzed against one particular variable. The variable which accounts for the most significant difference between the two groups enters

the discriminant equation first. After that, the next most significant variable which accounts for unique additional variance enters the equation. Variables continue to enter the discriminant analysis until no additional variables significantly discriminating between the groups are found. (The analysis here found twelve out of the twenty-two variables tested significantly discriminated between vocational and non-vocational students tested. See Chapter IV.) This method permits the discriminating power of a particular variable to be determined with more certainty because the distorting influence of the other variables is removed.(Letter from Dr. Gary E. Price, March 1989)

The Learning Style Inventory

The Learning Style Inventory was first developed by Doctors Rita and Kenneth Dunn in 1967.(1) To measure the factors set out in the Inventory, they designed The Learning Style Questionnaire. This was one of the first instruments developed to measure those personal characteristics affecting how an individual learns. Up to this point, no existing instrument was considered to be a reliable or valid indicator of learning style.

Since that time, Dr. Gary E. Price, an associate of the Dunns, has further refined and revised this instrument, now titled the Learning Style Inventory. This test was first completed and marketed in 1975. It has since been modified in 1978, 1984, and 1985. According to the authors of the test, Dunn, Dunn and Price, these revisions have improved the test's discriminating ability and permitted greater flexibility on the part of the respondents.(2) The current test is published by Price Systems, Inc. of Kansas.

Reliability and validity

The present test has shown a reliability of .60 for 77 percent of the test, with the highest reliability being in the following areas:

noise level
light
temperature
design
motivation
persistence
responsibility
learning alone/peer oriented
authority figure present
tactile preference
kinesthetic preference
intake
time of day
mobility
parent motivated
teacher motivated.(3)

The Learning Style Inventory has also demonstrated high face and construct validity(4) as well as predictive validity.(5)(6)(7)

Format

The Learning Style Inventory is based on factor analysis of twenty-two factors or subscales encompassed by 104 questions. It is appropriate for students in grades five through twelve. The LSI for grades five through twelve is designed as a five point Liekert scale with responses ranging from "strongly agree" to "strongly disagree." The written test option was used for this study. Students were asked to answer each question as if they were explaining how they would work or study best when trying to learn new or different information or skills. They were requested to respond with their first reaction and erasures on the Inventory were discouraged.(8) The average time to administer the test was from thirty to forty minutes, which is considered normal.

Interpretation of the Learning Style Inventory

The Learning Style Inventory is computer scored. The test administrator receives five printouts after the scoring. The first of these is the individual profile.

Each profile includes the student's name, raw score, standard score, LSI area, and a graph of the student's learning style. The standard score mean is 50 with a standard deviation of ten. The test was normed on over 500,000 students.(9)

A student with a score of 60 or above on the Learning Style Inventory demonstrates a strong preference for that particular style. A student with a score of 40 or less has a low preference in that area. Scores that fall from 41 to 59 indicate that the factor is not important to the individual. The authors contend that a consistency score of 70 percent or higher indicates that the results are reliable for that student.(10)

Price Systems

Since the methodology of this study involved the utilization of the Learning Style Inventory developed by Dunn, Dunn and Price, it was most appropriate to employ the computerized statistical package created by Dr. Gary E. Price specifically for the analysis of Learning Style Inventory results. A number of researchers have also utlized Dr. Price's scoring, statistical analysis and expertise.(2)(5)(6)(7) The use of Dr. Price's computation

in this study allows for a more sophisticated statistical analysis than otherwise would have been possible, and also allows for comparison with other studies that used the same package.

Hypothesis

The following null Hypothesis was tested:

The learning styles of students participating in vocational-technical education are not significantly different than those of students receiving their education in a comprehensive school. This was tested at the .05 level of significance.

Endnotes

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CHAPTER IV

FINDINGS

This chapter deals with the analysis of the data derived from the study. A stepwise discriminant analysis was performed in order to determine whether or not significant differences exist between vocational students and non-vocational students. In addition, a descriptive analysis considered each of the twenty-two variables studied, comparing the scores of the two groups for each variable. The results of both analyses are tabulated and discussed.

The Discriminant Analysis

The stepwise discriminant analysis of the data performed by Price Systems (See appendix for Price's letter of the abstracted data from the discriminant analysis) showed a total of twelve out of the twenty-two variables tested to significantly discriminate between the vocational and non-vocational groups at the .00001 level.(Table 5) Overall, the discriminant equation was able to accurately predict which group an individual belonged to 68.8 percent of the time, using the weighted scores on the twelve variables.

The first variable to enter the discriminant equation (because it accounted for the most significant difference between the groups) was Parent Figure Motivated. Overall, the non-vocational students were more motivated by parent figures than were the vocational students. This means that they were likely to learn because a parent figure was perceived as wanting them to do so.

The second variable to enter the equation was Noise Level. More non-vocational students demonstrated a preference for the presence of sound than did vocational students.

The third variable was Teacher Motivated. Vocational students were more likely to want to learn because their teachers wanted them to than were non-vocational students. (This variable shows only a slight mean difference, but that is nonetheless significant to the discriminant analysis.)

Learn in Several Ways was the fourth variable to enter the analysis. More students in non-vocational programs preferred to learn in several ways than did vocational students.

The fifth variable to enter the discriminant analysis was Responsible, with the non-vocational students demonstrating a higher degree of responsibility or

conformity, generally indicating that they were more likely to do what was expected or requested of them.

Light was the next variable to enter the equation. Non-vocational students favored brighter light for working than did vocational students.

The seventh variable to enter the discriminant equation was Authority Figures Present. More vocational than non-vocational students liked to have an authority figure present while learning.

The eighth variable was Kinesthetic. The non-vocational students indicated a greater preference for kinesthetic learning than did vocational students.

Evening and Morning was the ninth variable to enter the analysis, with vocational students showing a preference for learning in the evening and non-vocational students preferring to learn in the early morning.

The Late Morning variable was next, with more non-vocational than vocational students preferring to learn in the late morning hours as opposed to other times of day.

The eleventh variable to enter the discriminant analysis was Tactile. Overall, the non-vocational students indicated that they were slightly more tactile than were the students in the vocational area.

Twelfth and last to enter the equation was the Temperature variable. Non-vocational students generally

preferred a warmer environment for learning than did vocational students tested.

Certain variables tested failed to demonstrate a significant difference between vocational and non-vocational students. They were Design, Motivation, Persistence, Structure, Visual, Requires Intake, Afternoon, Learning Alone/Peer, Auditory, and Needs Mobility.

Table 3
A COMPARISON OF CATEGORIES SHOWING A HIGH LEVEL OF SIGNIFICANCE AT THE .00001 LEVEL USING A DISCRIMINANT ANALYSIS OF VOCATIONAL AND NON-VOCATIONAL STUDENTS ON THE LEARNING STYLE INVENTORY

Order of Significance	Variable	Vocational Means	Non-Vocational Means
1	Parent Figure Motivated	15.86	16.82
2	Noise level	13.48	14.81
3	Teacher Motivated	18.06	18.00
4	Learn in Several Ways	11.94	13.16
5	Responsible	12.31	13.42
6	Light	12.34	13.34
7	Authority Figures	11.43	11.36
8	Kinesthetic	23.01	24.47
9	Evening-Morning	15.09	13.90
10	Late Morning	10.39	11.09
11	Tactile	16.36	16.40
12	Temperature	16.78	17.83

N=77
(The ten variables excluded from this table did not show a significant level of discrimination)

Descriptive Analysis

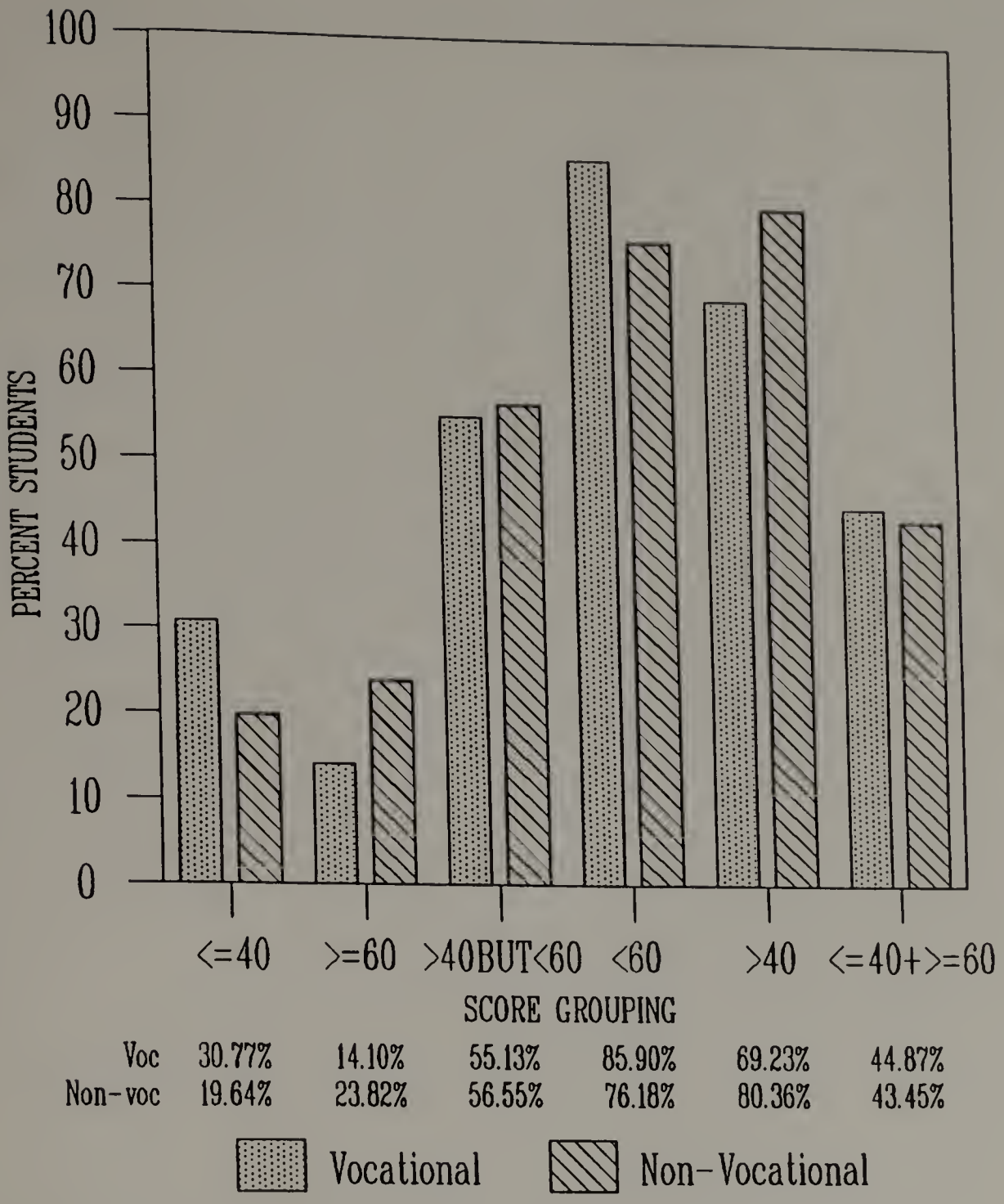
A descriptive comparison of vocational and non-vocational students on each variable is also provided. For purposes of this analysis, students were grouped on each variable tested by their raw score on that variable. The score parameters for the groups were those considered significant by Dunn, Dunn, and Price. The possible test scores for each variable ran from one to one hundred. A score of equal to or less than forty is considered to be significantly low, and a score of equal to or greater than sixty to be significantly high. For each variable, therefore, the scores of both student groups have been tabulated to show the percentage of vocational students and non-vocational students scoring less than or equal to forty (indicated by the symbol <=40) and to show the percentage scoring equal to or greater than sixty (indicated by the symbol >=60). In addition, the scores have been arranged in groupings that include the "non-significant" middle range scores of forty-one to fifty-nine. The percentage of students in each group who scored from forty-one to fifty-nine is shown for each variable. The symbol used here is >40BUT<60. This figure indicates the percentage of individuals for whom a particular variable is not significant and will not affect learning.

Also shown is the percentage in both groups whose scores were less than sixty, designated by the symbol <60. This grouping includes students whose scores were significantly low as well as those who showed no partiality as to that variable. Presumably all such students could learn effectively in a similar environment; for example, the data presented in the <60 column of the graph of Subscale 1 -- Noise Level, infra (Figure 1), indicates that 85.90 percent of vocational students tested either prefer a quiet learning environment or are indifferent to the noise level. Of that number, then, some would benefit by silence and the rest would not be adversely affected. The scores have also been tabulated to group the percentage of students whose scores were higher than forty. This grouping is designated by the symbol >40. Again using the Subscale 1 -- Noise Level graph (figure 1) for illustration, this grouping includes the 69.23 percent of vocational students who prefer a learning environment with music and conversation, or who do not care whether these features are present or not. All of these students would learn in a setting that included some noise.

Lastly, scores have been tabulated to group the percentage of students in both groups who scored significantly high (sixty or more) or significantly low

(forty or less). This grouping shows the percentage of students for whom accommodation to the variable tested is important to learning. It is designated by the symbol <=40+>=60.

In the discussion that follows, each of the twenty-two variables tested is considered individually. For each variable, the commentary is preceded by a graph illustrating the six groupings described above.



A score of less than forty on the Noise Level variable indicates a preference for a quiet learning environment.

Figure 1. Percent Responses for Subscale 1

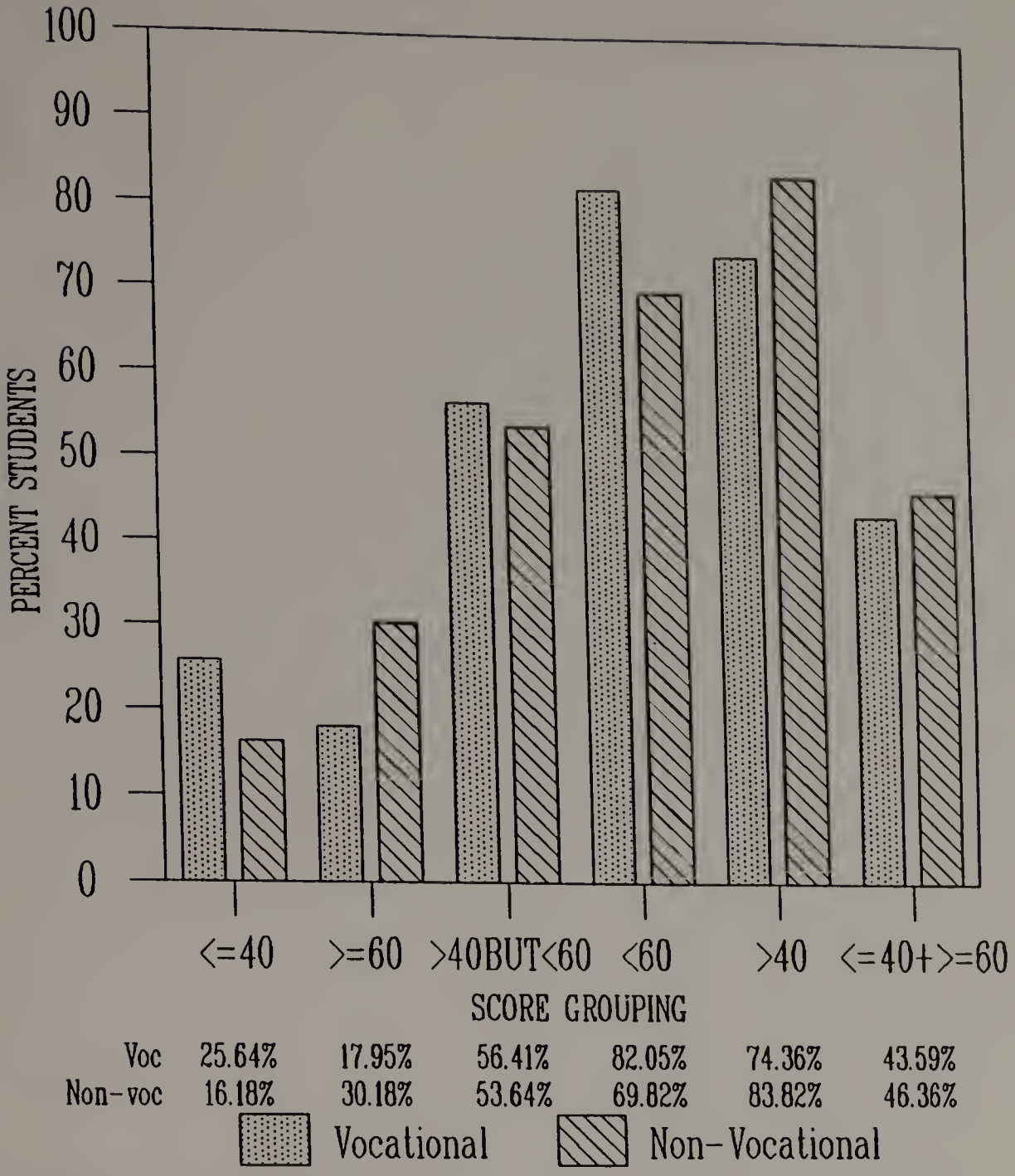
Noise Level

Noise Level:

The data (figure 1) for the noise variable shows that 30.77 percent of the vocational students tested prefer quiet, while only 19.64 percent of non-vocational students tested shared that preference. More non-vocational students (23.82 percent) than vocational students (14.10 percent) preferred an environment with music or conversation while working. More than half of the students in both groups were indifferent to the noise level (56.55 percent of the non-vocational students and 55.13 percent of the vocational students).

Tabulations including the "non-significant" middle range scores indicate that 85.90 percent of vocational students tested would do well in a quiet learning environment, while 80.36 percent of non-vocational students tested would perform well in a learning environment that included music or conversation.

Noise Level was an important factor in learning style for 44.87 percent of vocational students tested and for 43.45 percent of non-vocational students tested.



A score of equal or less than forty on the Light variable indicates a preference for diffused or indirect light rather than bright light in the learning environment. A score of equal to or greater than sixty indicates a preference for bright, direct light.

Figure 2. Percent Responses for Subscale 2

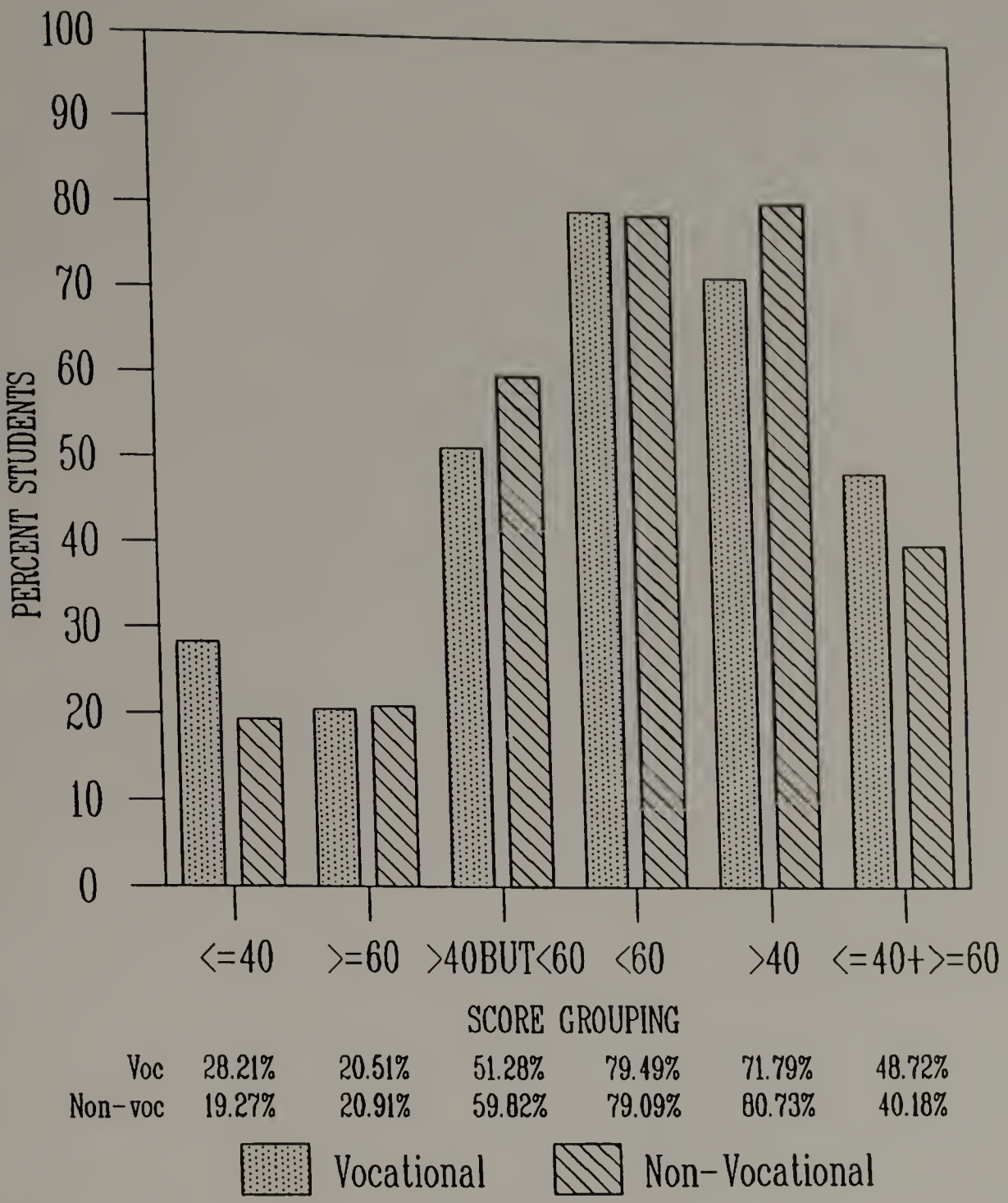
Light

Light:

Twenty-five and sixty four one hundredths percent of the vocational students tested preferred indirect, diffused light (Figure 2). Only 16.18 percent of non-vocational students tested shared that preference, with 30.18 percent of those students showing a preference for bright, direct light such as that provided by sunny windows or table lamps. Bright light conditions were favored by 17.95 percent of the vocational group. Light was not an important variable for 56.41 percent of the vocational students and 53.64 percent of the non-vocational students.

When the "non-significant" middle range scores are included, the results suggest that 82.05 percent of the vocational students tested would do well in a subdued light, while 69.82 percent of non-vocational students in the sample would do well in indirect light conditions.

Light levels were important for 43.59 percent of the vocational students and for 46.36 percent of the non-vocational students.



A score of forty or less on the Temperature variable indicates a preference for coolness, and a score of sixty or above shows a preference for warmth.

Figure 3. Percent Responses for Subscale 3

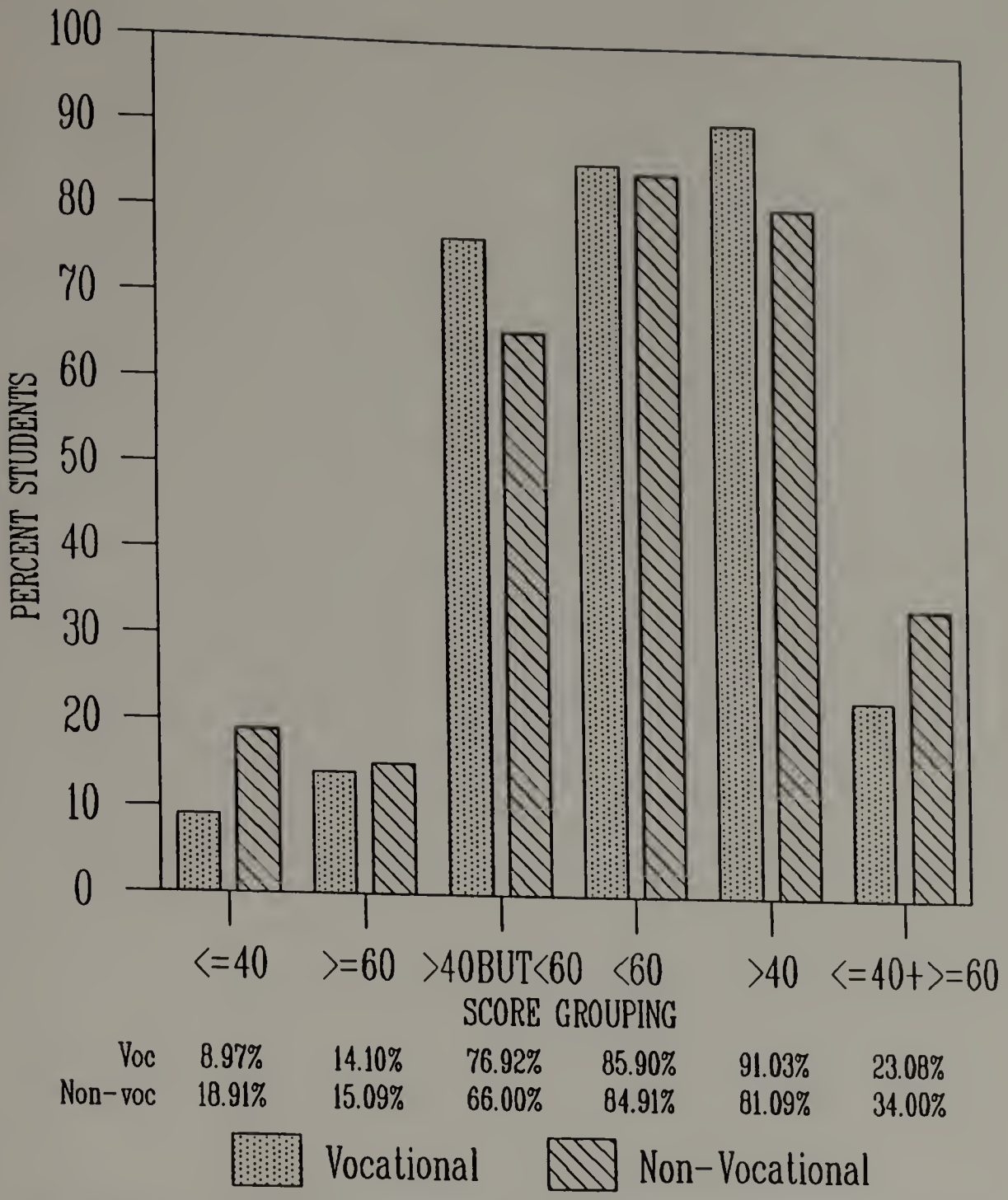
Temperature

Temperature:

Cool conditions (Figure 3) were preferred by 28.21 percent of the vocational students tested and by 19.27 percent of the non-vocational students sampled. Warmth was the choice of 20.91 percent of the non-vocational group and of 20.51 percent of the vocational group. This variable was not significant to 59.82 percent of the non-vocational students and 51.28 percent of the vocational students tested.

Results when the "non-significant" middle range scores are included are quite close for vocational and non-vocational groups. Under cool conditions, 79.49 percent of the vocational students and 79.09 percent of the non-vocational students should do well. If the environment is warmer, 80.73 percent of the non-vocational students and 71.79 percent of the vocational students should perform well.

Temperature is a significant environmental factor for 48.72 percent of the vocational group and for 40.18 percent of the non-vocational group.



The Design variable is intended to demonstrate a preference along a scale from a traditional, structured physical environment (shown by a score of sixty or more) to a nontraditional, informal physical setting (shown by a score of forty or less).

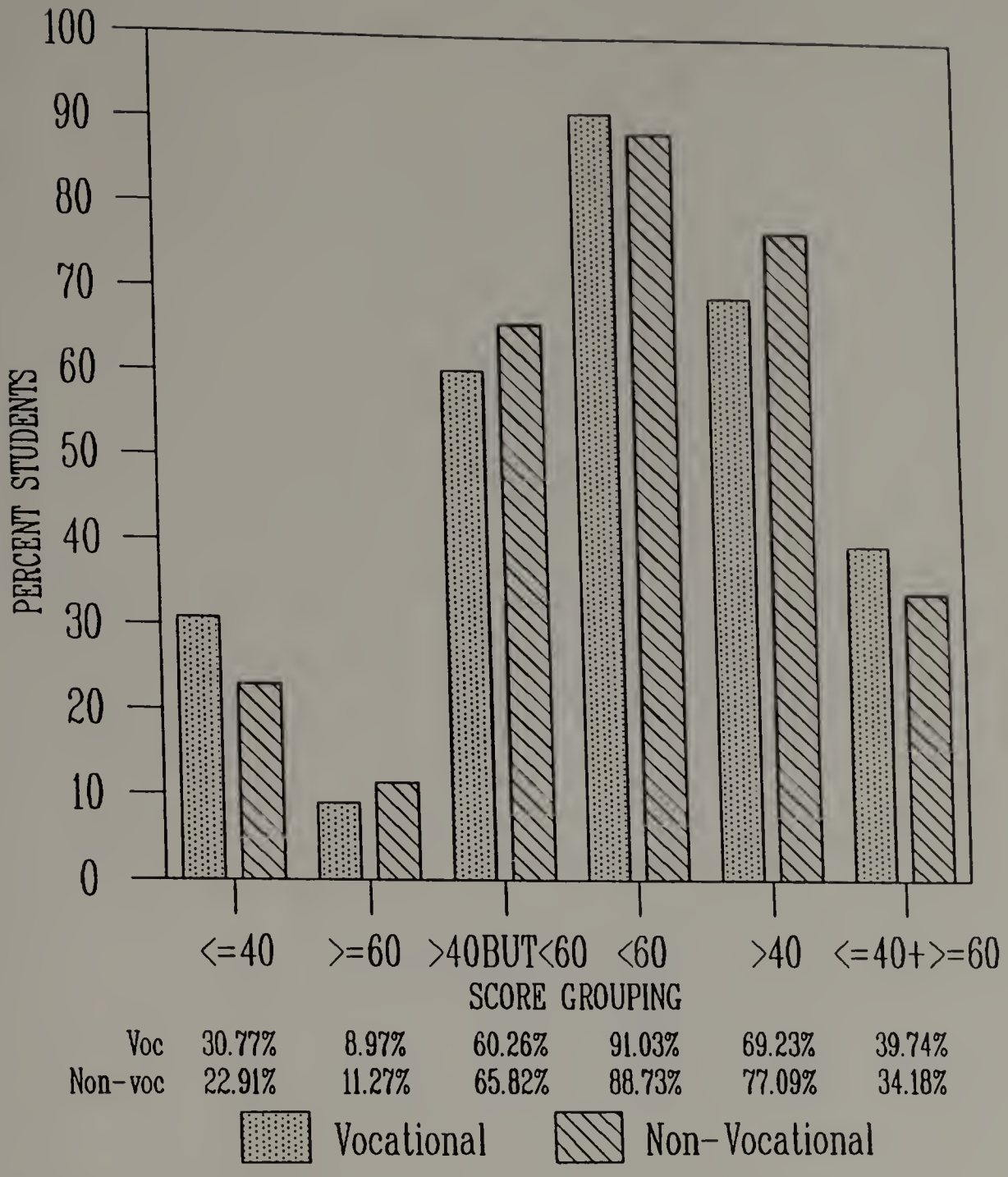
Figure 4. Percent Responses for Subscale 4

Design

Design:

The results of this study (Figure 4) indicate that this variable had little significant impact for either group. A formal, structured physical environment was the preference of 14.10 percent of the vocational students tested and of 15.09 percent of the non-vocational students tested. An informal environment was the choice of 18.91 percent of the non-vocational group and of 8.91 percent of the vocational sample. This variable was not significant for 76.92 percent of the vocational students and for 66.00 percent of the non-vocational students.

Design had significance for only 34.00 percent of the non-vocational group and for 23.08 percent of the vocational group.



A score of forty or less on this variable demonstrates a student preference for lessons structured in short, uncomplicated segments with frequent teacher-student interaction and positive reinforcement.

Figure 5. Percent Responses for Subscale 5

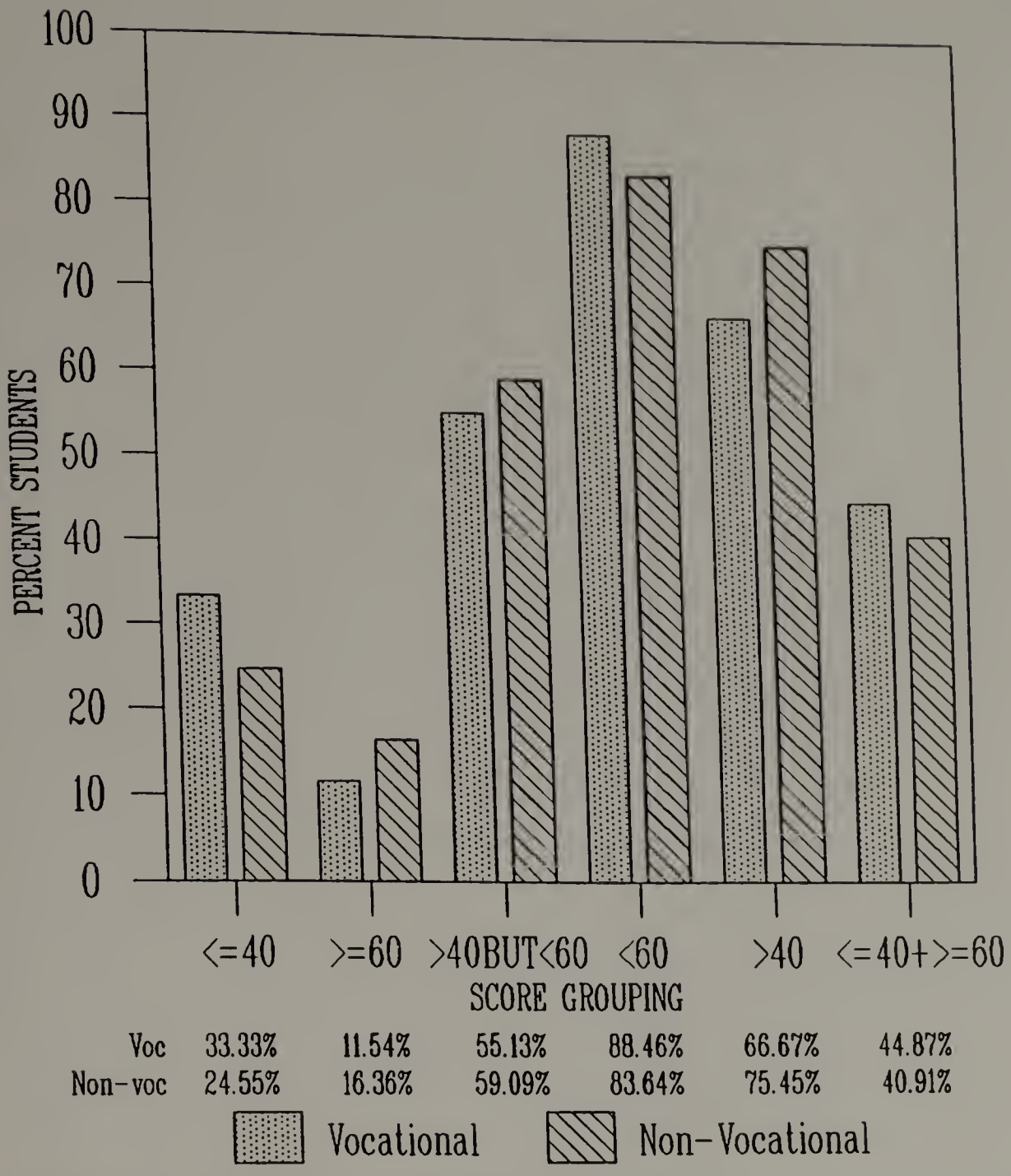
Motivation

Motivation:

Thirty and seventy seven one hundredths percent of the vocational students tested (Figure 5) and 22.91 percent of the non-vocational students showed a preference for lessons structured in short uncomplicated segments with frequent teacher-student interaction and positive reinforcement. 11.27 percent of the non-vocational group and 8.97 percent of the vocational group indicated a preference for self-designed assignments with self-pacing and rapid advancement. The Motivation variable was not important to 65.82 percent of the non-vocational students and to 60.26 percent of the vocational students.

Inclusion of the "non-significant" middle-range scores suggests that 91.03 percent of the vocational students and 88.73 percent of the non-vocational students would learn well in an environment with structured lessons and frequent reinforcement. Those who would do well in a less structured, self-motivated situation include 77.09 percent of the non-vocational students and 69.23 percent of the vocational group.

Motivation was important to 39.74 percent of the vocational students tested and to 34.18 percent of the non-vocational sample.



A score of forty or less indicates a preference for short assignments, plenty of praise, and frequent checks on progress while a score of sixty or more shows a liking for long term projects with supervision and assistance only when requested.

Figure 6. Percent Responses for Subscale 6

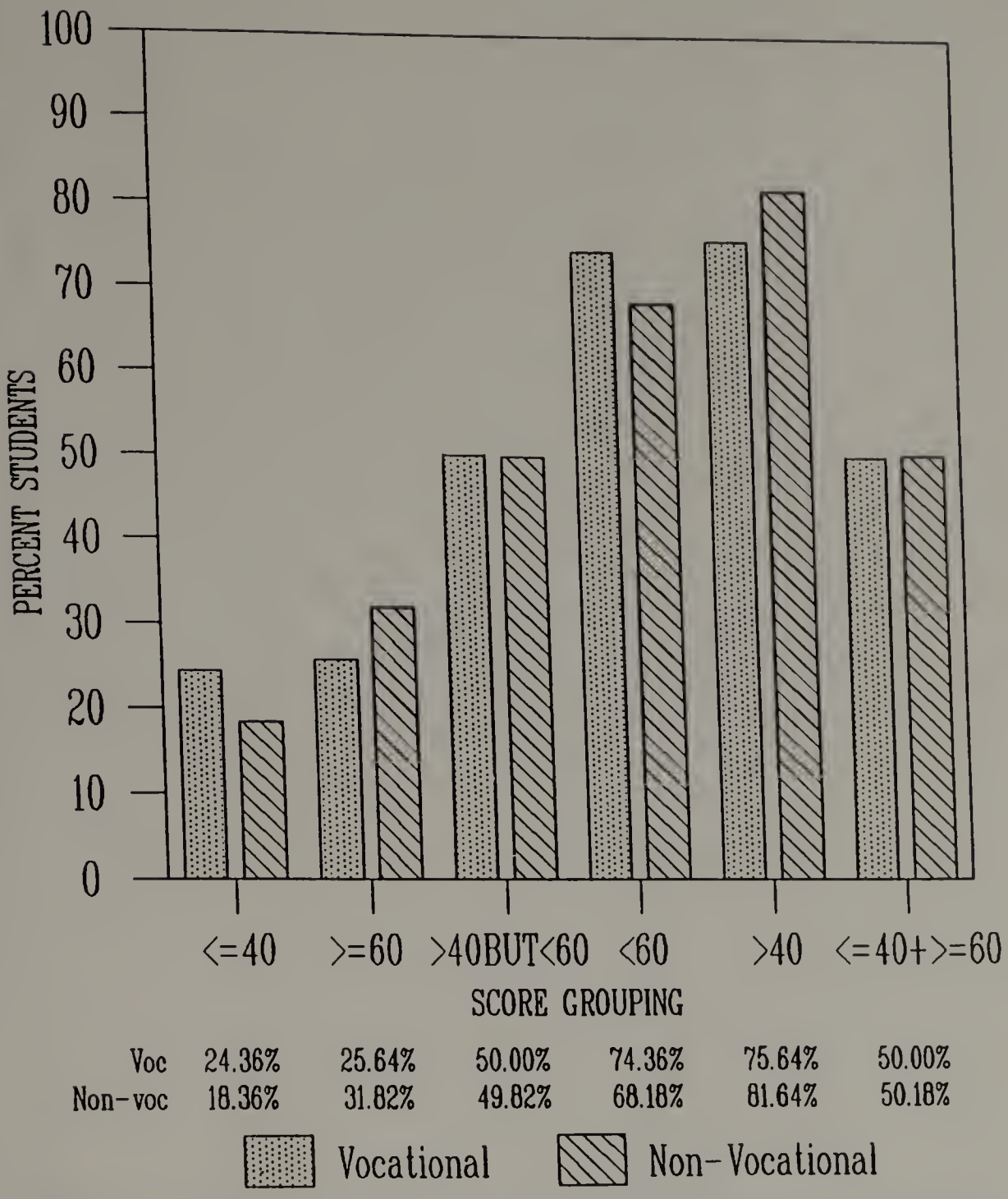
Persistent

Persistent:

Thirty three and thirty three one hundredths percent of the vocational students tested demonstrated the less persistent style (Figure 6), as did 24.55 percent of the non-vocational students. The more persistent style was preferred by 16.36 percent of the non-vocational group and by 11.54 percent of the vocational group. No significant preference was shown by 59.09 percent of the non-vocational students nor by 55.13 percent of the vocational students.

The more structured, less persistent style could be used successfully with 88.46 percent of the vocational students and with 83.64 percent of the non-vocational students. These figures are calculated by including the "non-significant" middle-range scores.

Persistence was an important variable to 44.87 percent of the vocational group and to 40.91 percent of the non-vocational group.



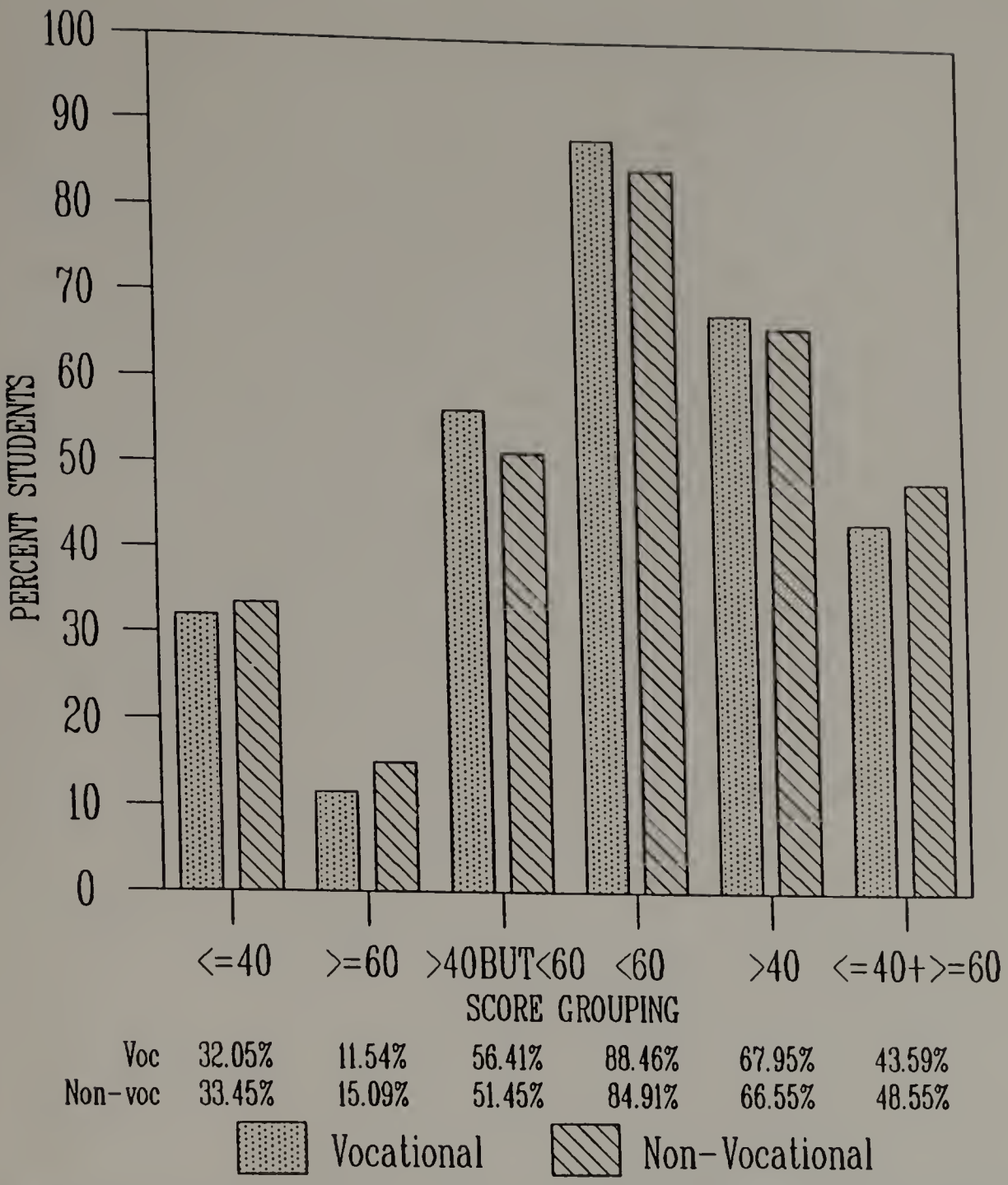
A score of forty or less on the Responsible variable indicates a preference for short term assignments with single or, at most, dual goals, few options, and frequent checks by the teacher.

Figure 7. Percent Responses for Subscale 7

Responsible

Responsible:

The "less responsible" style was demonstrated by 24.36 percent of the vocational students and by 18.36 percent of the non-vocational group (Figure 7). The "more responsible" style was shown by 31.82 percent of the non-vocational students and by 25.64 percent of the vocational group. Only 50.00 percent of vocational and 49.82 percent of non-vocational students tested were indifferent to this variable. These are notably low figures. For about half of all the students tested, this variable is an important factor in their academic success.



A score of forty or less on this variable indicates a preference for a teaching approach that clearly states objectives while offering choices of methodology and resources, and opportunities for creativity.

Figure 8. Percent Responses for Subscale 8

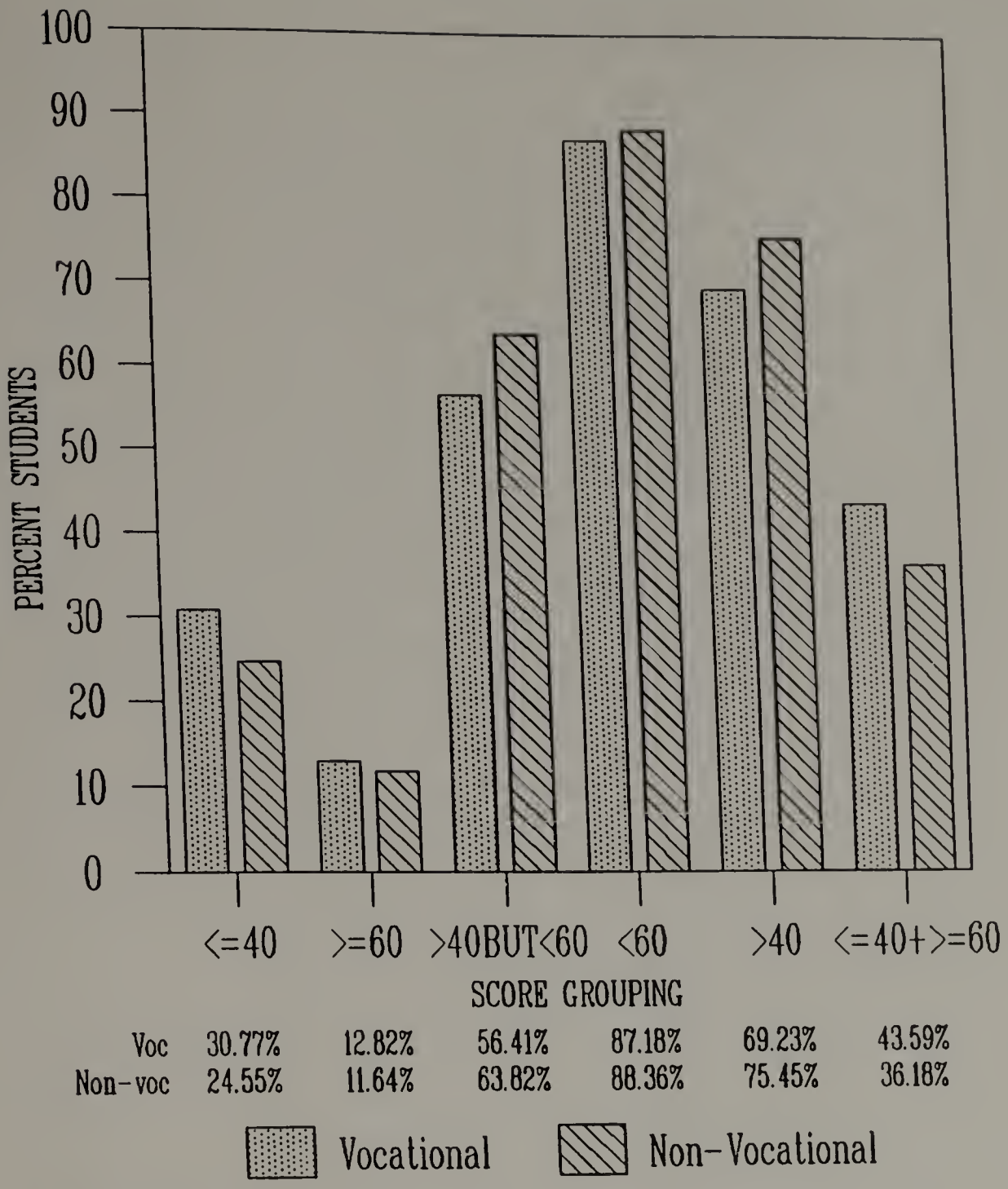
Structure

Structure:

A score of forty or less on this variable (Figure 8), which was achieved by 33.45 percent of the non-vocational group and by 32.05 percent of the vocational group, indicates a preference for a teaching approach the clearly states objectives while offering choices of methodology and resources, and opportunities for creativity. A score of sixty or more, on the other hand, indicates a preference for precise directions as to every aspect of an assignment with no options allowed. Scores of sixty and above were achieved by 15.09 percent of non-vocational students and by 11.54 percent of the vocational group. No preference was shown by 56.41 percent of the vocational students tested and by 51.45 percent of the non-vocational students.

When the "non-significant" middle range scores are included, it appears that 88.46 percent of the vocational sample and 84.91 percent of the non-vocational group could be taught effectively using a teaching methodology that allows for flexibility, choice, and creativity.

This variable was an important component in the learning styles of 43.59 percent of the vocational group and 48.55 percent of the non-vocational group.



A score of forty or less on this variable indicates that the student prefers to learn alone. A score of sixty or greater indicates a preference for learning in groups.

Figure 9. Percent Responses for Subscale 9

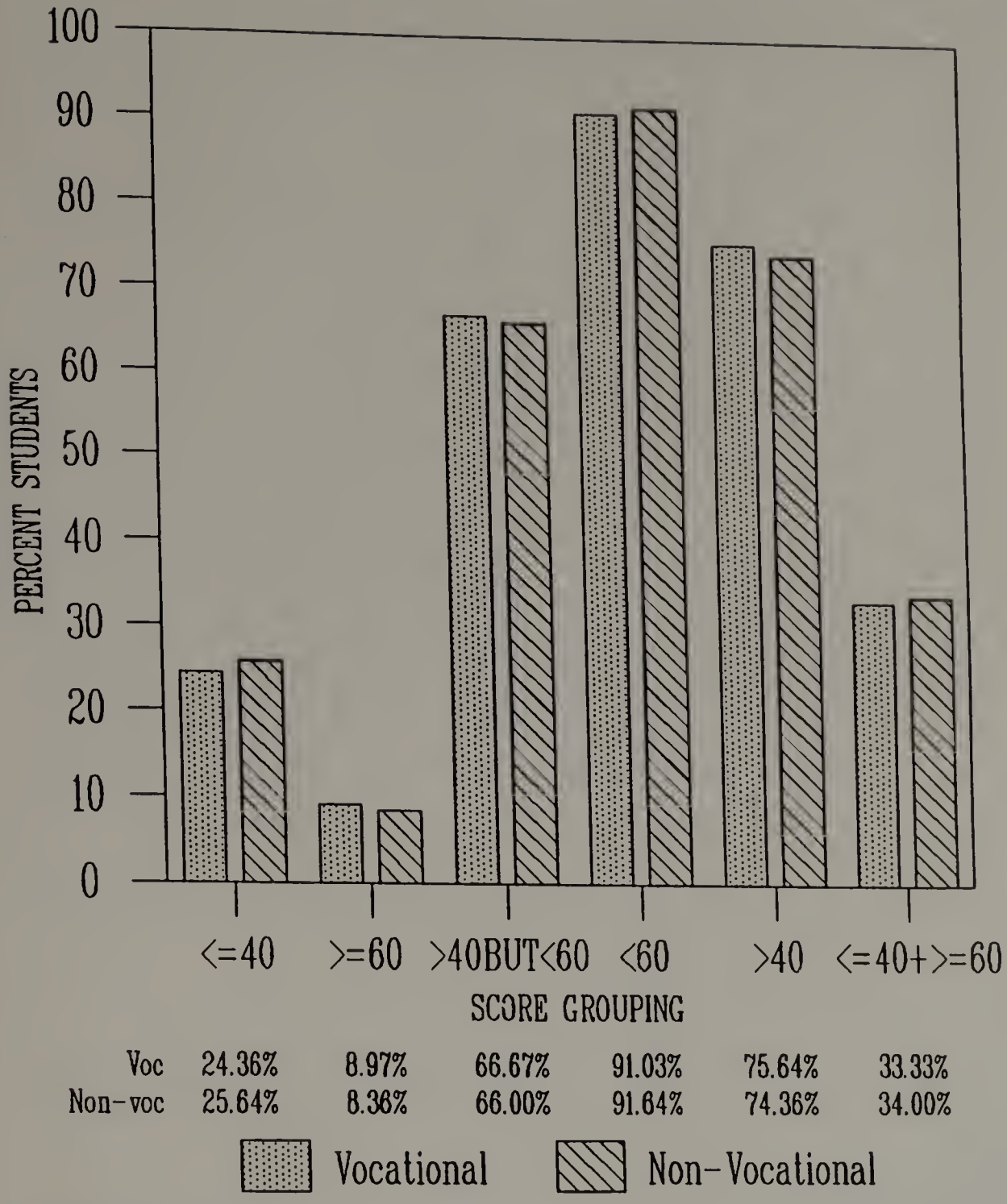
Learning Alone/Peer Oriented

Learning Alone/Peer Oriented:

Of the students tested, 30.77 percent of the vocational students and 24.55 percent of the non-vocational students indicated that they prefer to learn alone (Figure 9), using self-selected objectives, procedures, and evaluations. Those who scored sixty or more demonstrated a preference for working in groups, with guidance from group suggestions and recommendations. This preference was exhibited by 12.82 percent of the vocational students and 11.64 percent of the non-vocational students. No preference in either direction was demonstrated by 63.82 percent of the non-vocational sample and by 56.41 percent of the vocational group.

Adding in the "non-significant" middle range scores suggests that 87.18 percent of the vocational students and 88.36 of the non-vocational group could be effectively taught in the "Learning Alone" mode. By contrast, 75.45 percent of non-vocational students and 69.23 percent of vocational students in the sample should do well while working in peer groups.

This variable had significance for 43.59 percent of the vocational students and for 36.18 percent of the non-vocational students tested.



This variable indicates preference for the presence or absence of a teacher while learning.

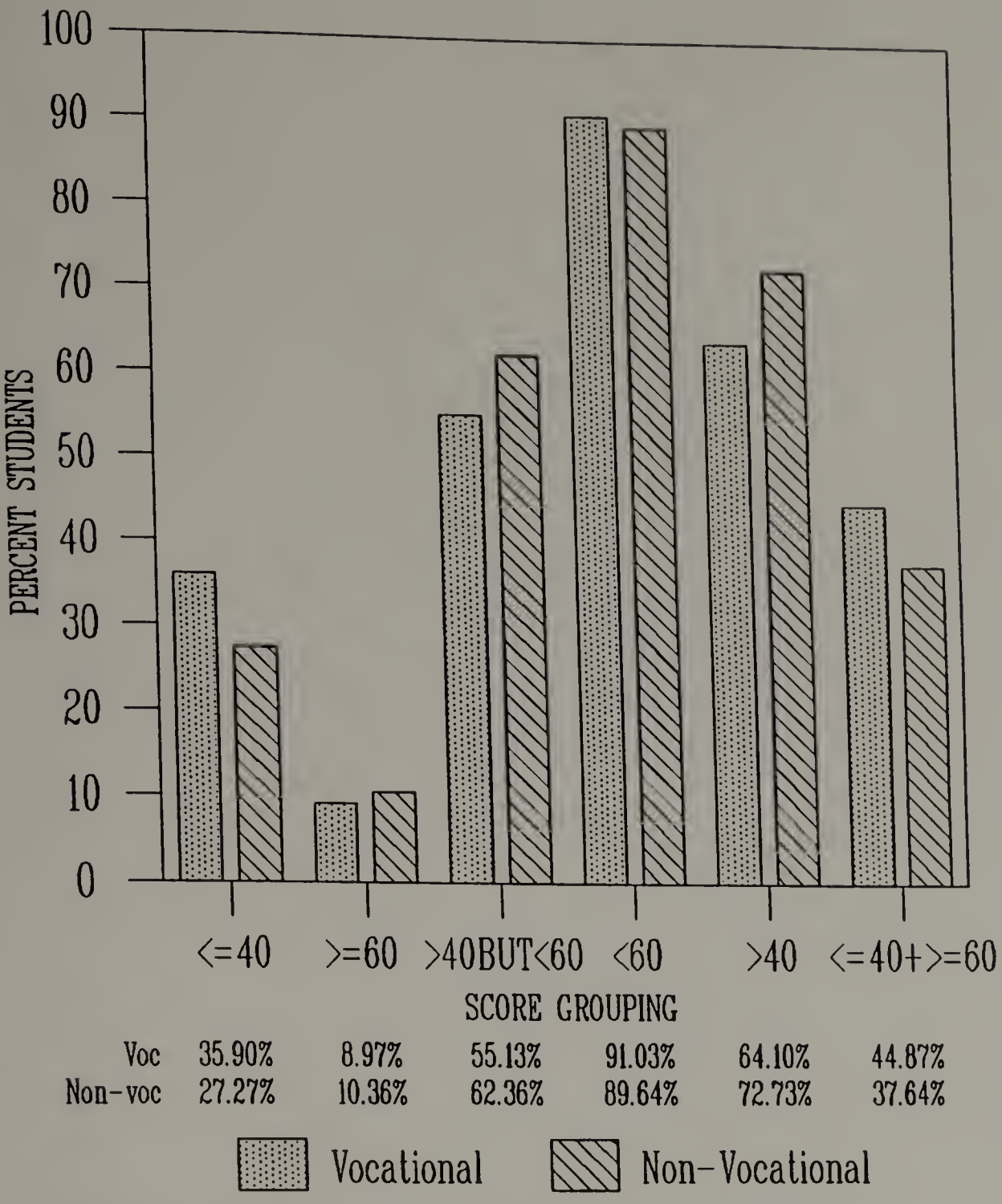
Figure 10. Percent Responses for Subscale 10

Authority Figure Present

Authority Figures Present:

This variable indicates preference for the presence or absence of a teacher while learning (Figure 10). A preference for isolated, unsupervised study was shown by 25.64 percent of non-vocational students and by 24.36 percent of the vocational students sampled. The presence and close supervision of a teacher was preferred by 8.97 percent of the vocational group and by 8.36 percent of the non-vocational students. This variable was of little concern to 66.67 percent of vocational and 66.00 percent of non-vocational students tested.

The data indicates that study unsupervised by a teacher will assist or at least be a neutral factor in the learning success of 91.64 percent of the non-vocational students and of 91.03 percent of the vocational students.



A score of forty or less on this variable indicates a preference for limited options in methodology without frequent or extensive changes.

Figure 11. Percent Responses for Subscale 11

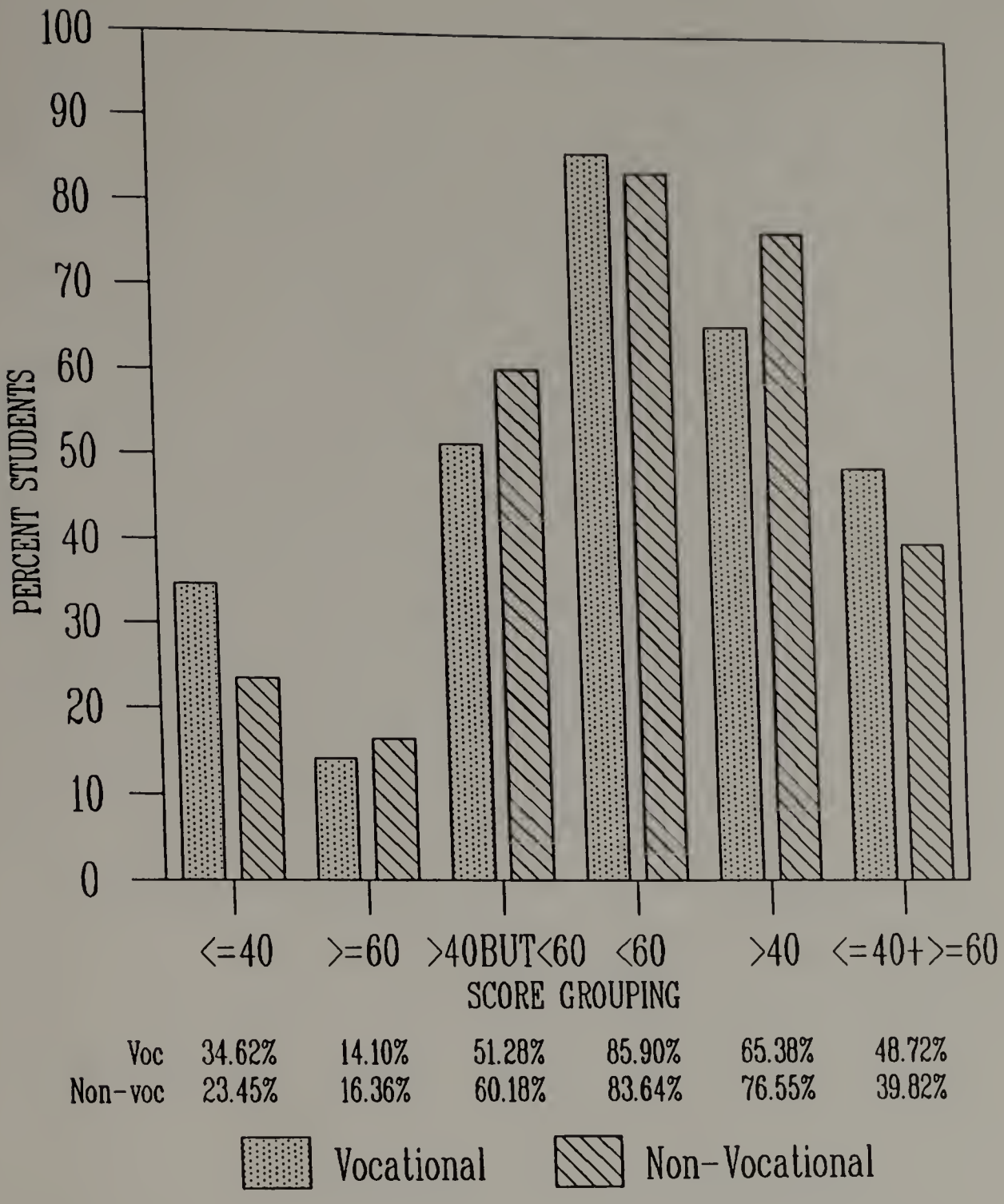
Learn in Several Ways

Learn in Several Ways:

The preference for limited options in methodology without frequent or extensive changes was shown by 35.90 percent of the vocational group and by 27.27 percent of the non-vocational students tested (Figure 11). On the other hand, a preference for a variety of learning patterns and experiences was shown by 10.36 percent of the non-vocational students and by 8.97 percent of the vocational sample. The variable was not significant to 62.36 percent of the non-vocational and 55.13 percent of the vocational group.

Consistency and limited methodology should work well for 91.03 percent of the vocational group and for 89.64 percent of the non-vocational group. These figures are obtained by including the "non-significant" middle range scores. Variety and change would well serve 72.73 percent of the non-vocational and 64.10 percent of the vocational group.

The variable had significance for 44.87 percent of the vocational students and for 37.64 percent of the non-vocational students.



A score of sixty or more demonstrates a preference for auditory learning.

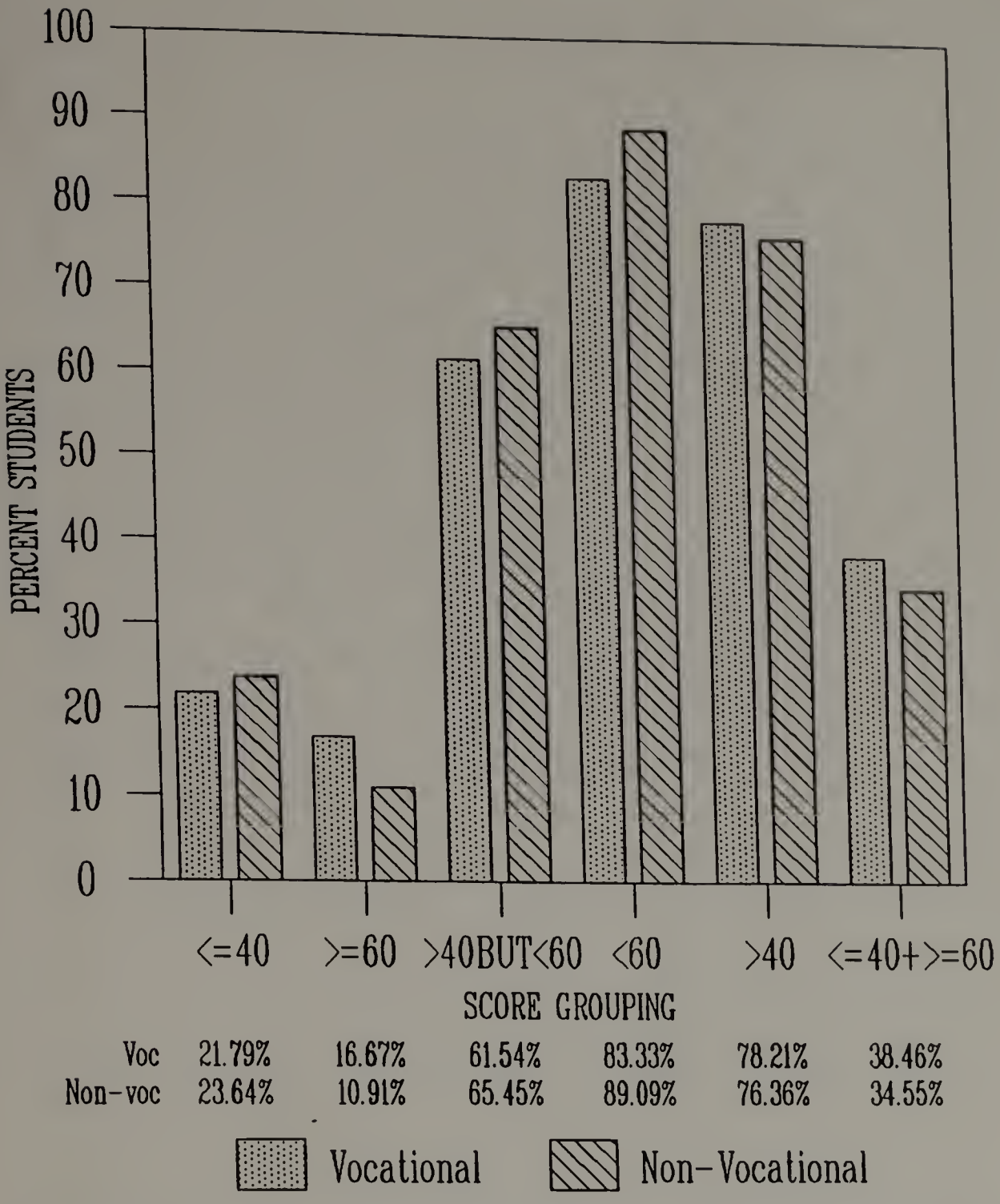
Figure 12. Percent Responses for Subscale 12

Auditory

Auditory:

A strong preference for auditory learning was demonstrated by 16.36 percent of the non-vocational students and 14.10 percent of the vocational students tested (Figure 12). On the opposite end of the scale, 34.62 percent of vocational students and 23.45 percent of non-vocational indicated that they are not auditory learners. No strong preference was shown by 60.18 percent of the non-vocational group and by 51.28 percent of the vocational sample.

When the "non-significant" middle range scores are included, it appears that only 65.38 percent of vocational students, as compared to 76.55 percent of non-vocational students, would be well served by a solely auditory presentation. This fact suggests that it may be important to provide a variety of resources and styles in order to facilitate learning.



A score of sixty or more demonstrates a strong preference for visual learning.

Figure 13. Percent Responses for Subscale 13

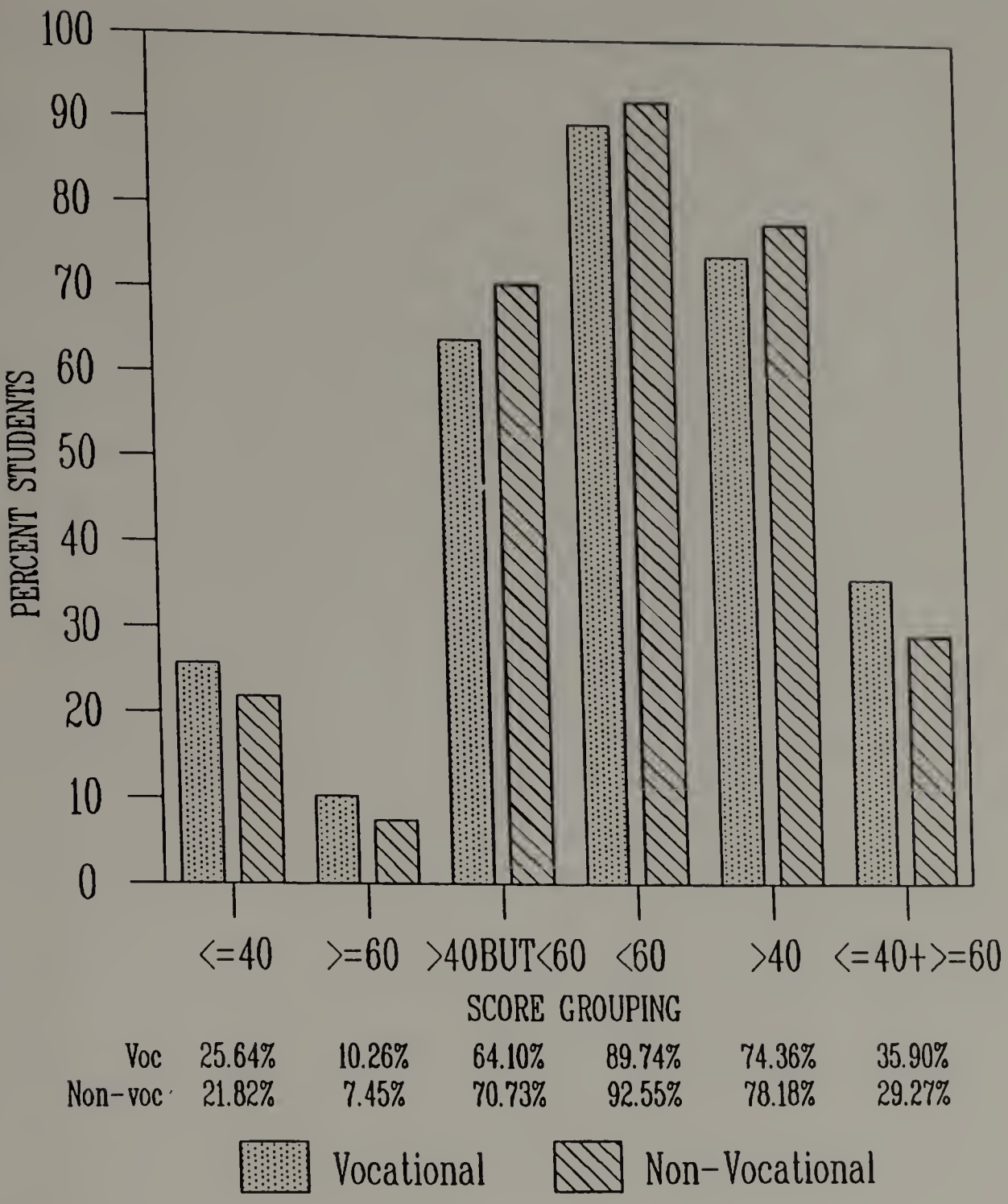
Visual

Visual Preferences:

The visual medium was the preferred learning style for 16.67 percent of the vocational students and for 10.91 percent of the non-vocational students tested (Figure 13). 23.64 percent of the non-vocational group and by 21.79 percent of the vocational students, indicated that they were not visual learners. This variable was not significant for 65.45 percent of the non-vocational and 61.54 percent of the vocational students.

When the "non-significant" middle range scores are added, it appears that 78.21 percent of the vocational students and 76.36 percent of the non-vocational students could learn effectively from visual presentation.

This variable is important to 38.46 percent of the vocational group and to 34.55 percent of the non-vocational group.



A score of sixty or more demonstrates a strong preference for tactile learning.

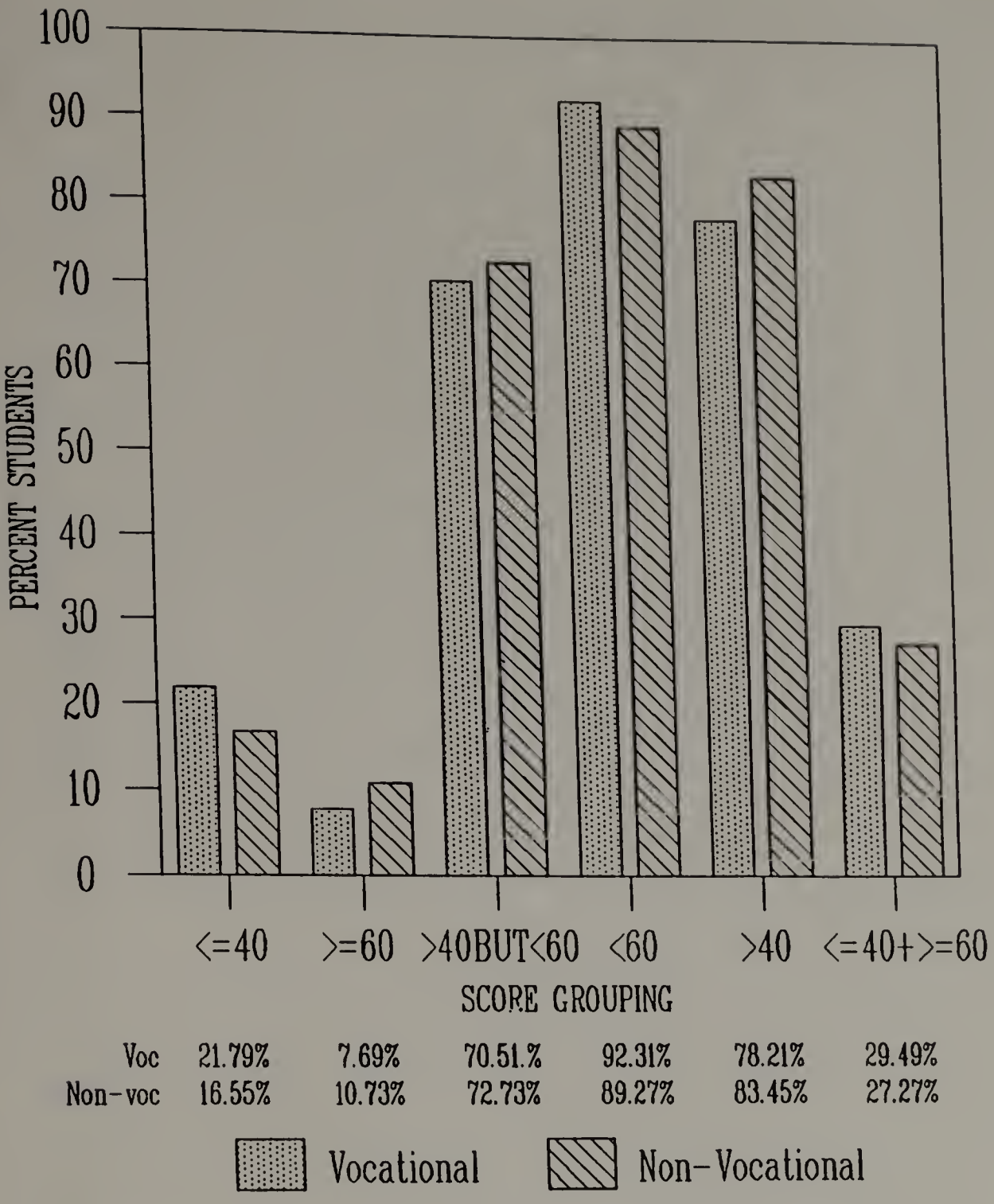
Figure 14. Percent Responses for Subscale 14

Tactile

Tactile Preference:

The preferred way of learning is tactile, or through the manipulation of material, for 10.26 percent of the vocational students tested and for 7.45 percent of the non-vocational students (Figure 14). Tactile learning was strongly disfavored by 25.64 percent of the vocational group and by 21.82 percent of the non-vocational group. No preference either way on this variable was exhibited by 70.73 percent of the non-vocational students and by 64.10 percent of the vocational students in the sample.

This variable is significant to 35.90 percent of the vocational students and to 29.27 percent of the non-vocational students.



A score of sixty or more demonstrates a student's preference for kinesthetic learning.

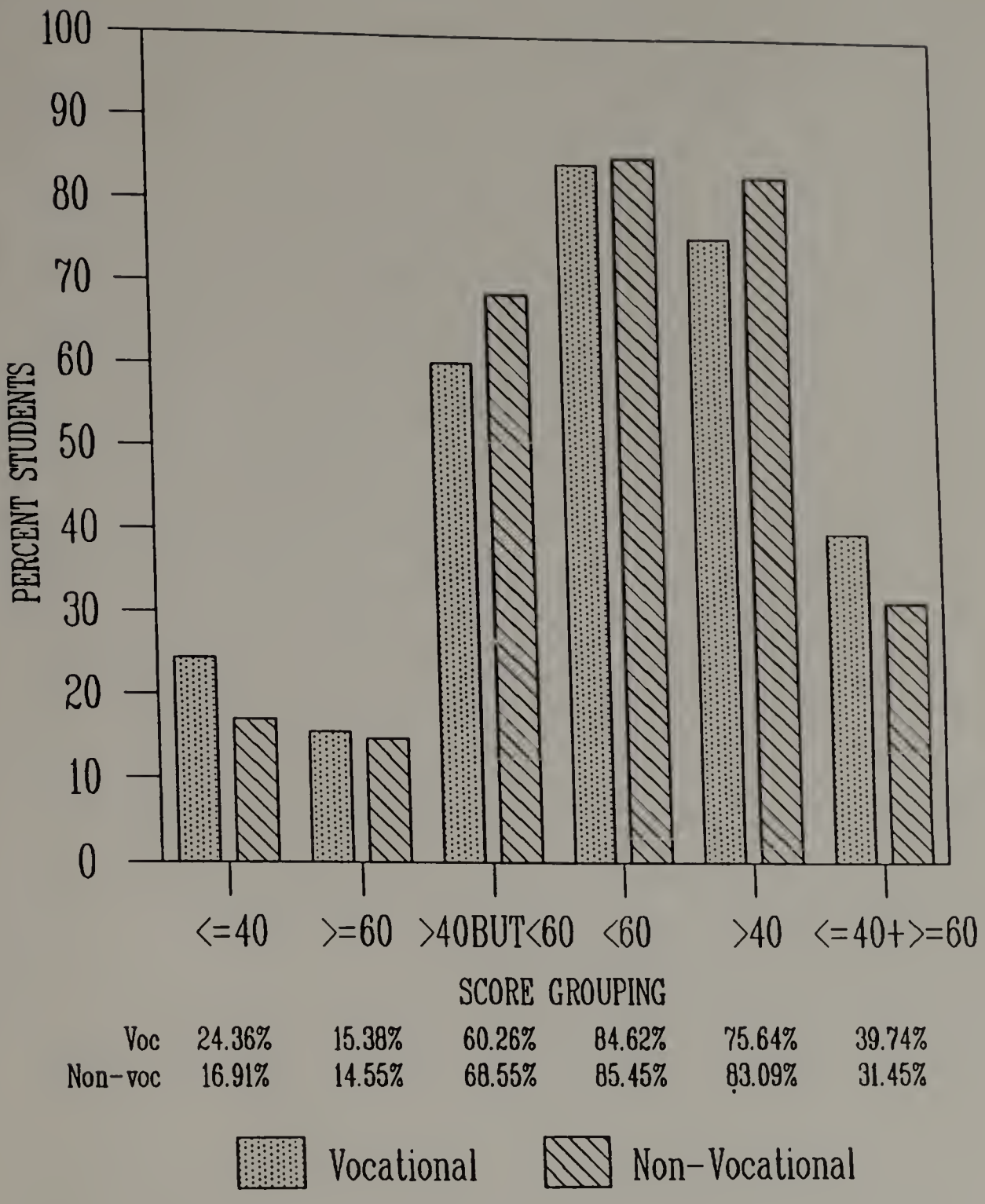
Figure 15. Percent Responses for Subscale 15 Kinesthetic

Kinesthetic Preference:

Only 7.69 percent of the vocational students and 10.73 percent of non-vocational students (Figure 15) exhibited a preference for kinesthetic learning, or learning through the experience of doing the thing taught. This style was strongly disfavored by 21.79 percent of the vocational students and by 16.55 percent of the non-vocational students, who scored forty or less. This was not an important factor for 72.73 percent of non-vocational students tested and for 70.51 percent of vocational students.

Effective learning through kinesthetic experience should be possible for 83.45 percent of the non-vocational group and for 78.21 percent of the vocational students. These figures include the "non-significant" middle range scores of those students who exhibited no strong preference on this variable, and who presumably would be neutral to the use of a kinesthetic presentation.

Kinesthetic Preference was a significant variable for 29.49 percent of the vocational sample and 27.27 percent of the non-vocational group.



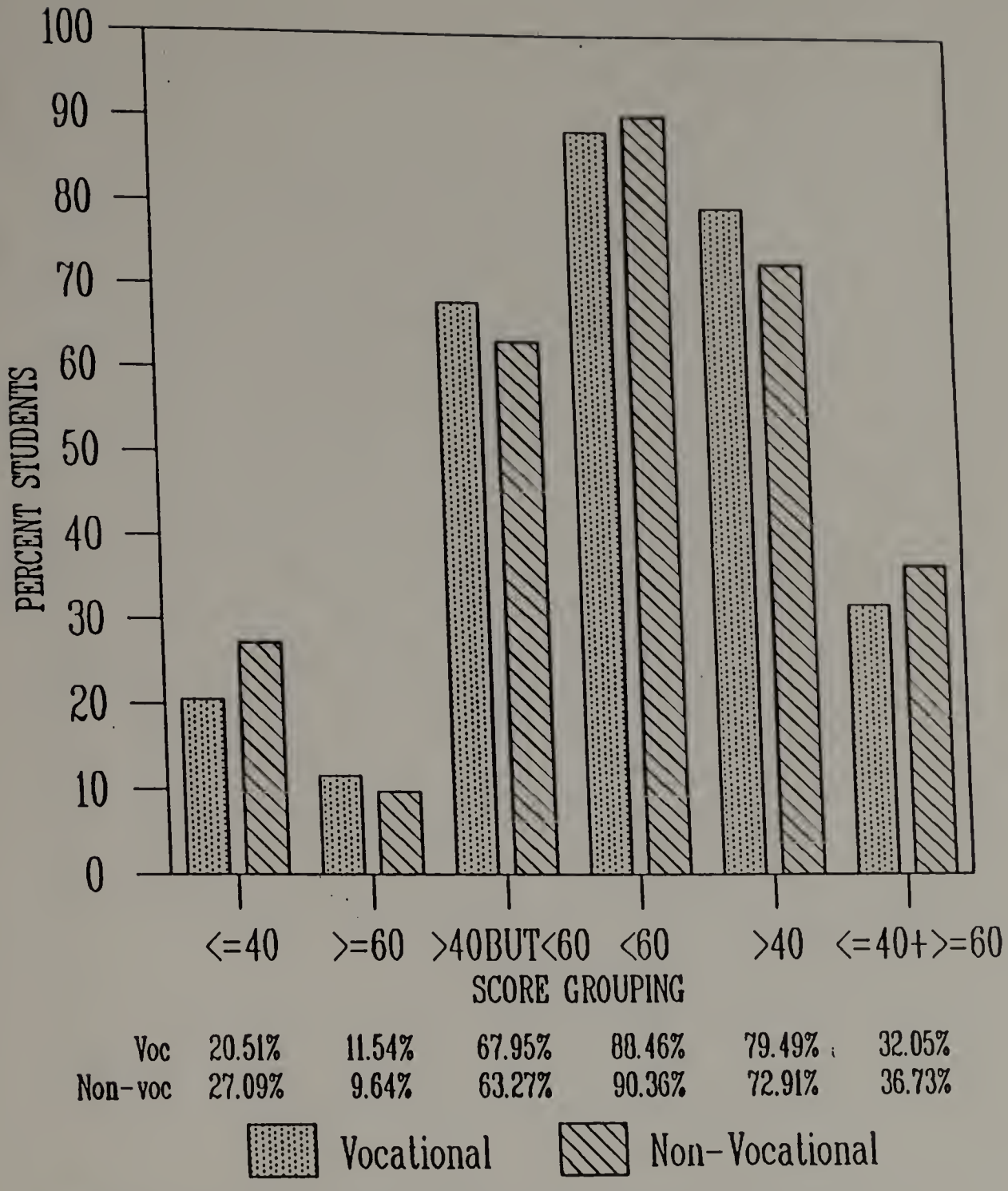
A score of sixty or more demonstrates that a student learns best while eating or drinking.

Figure 16. Percent Responses for Subscale 16

Requires Intake

Requires Intake:

Frequent opportunities to eat are preferred by 15.38 percent of the vocational students and by 14.55 percent of the non-vocational group (Figure 16). For the great majority of students in both groups, however, there is no advantage in providing regular snacks. No benefit would accrue to 85.45 percent of non-vocational and 84.62 percent of vocational students tested as the result of such accommodation.



A score of forty or less indicates a student who is an evening learner. A score of sixty or greater indicates a morning learner.

Figure 17. Percent Responses for Subscale 17

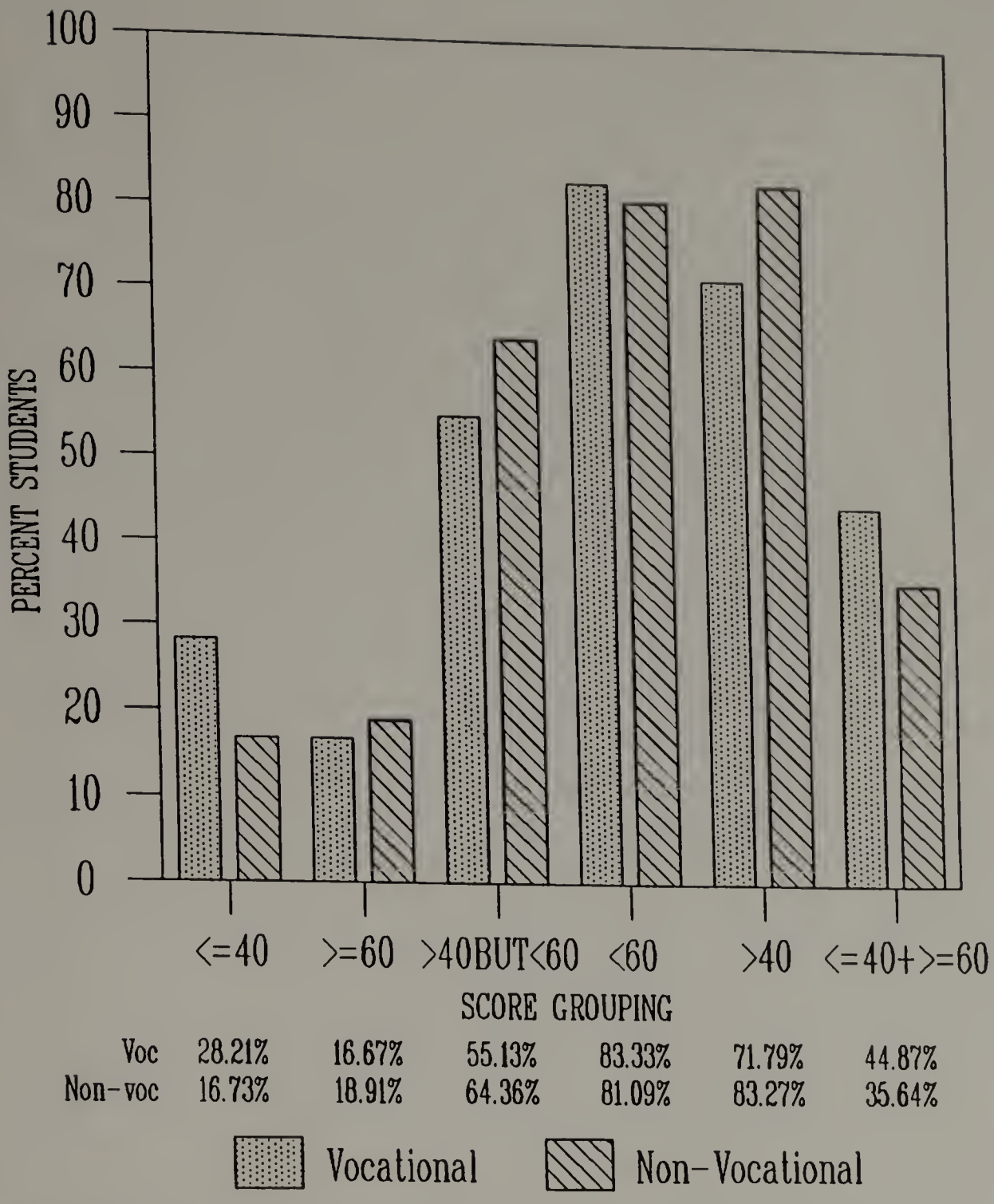
Evening/Morning

Evening/Morning:

A preference for learning in the evening was shown by 27.09 percent of the non-vocational students and 20.51 percent of the vocational students tested (Figure 17). These students, who scored forty or less on this variable, do better when they can attempt difficult assignments and homework in the evening hours. Working in the morning was preferred by 11.54 percent of the vocational and 9.64 percent of the non-vocational students. They scored sixty or above on this variable. No strong preference either way was indicated by 67.95 percent of the vocational group and by 63.27 percent of the non-vocational sample.

The percentage of students who either prefer evening learning or are indifferent is 90.36 for the non-vocational group and 88.46 for the vocational group. These figures include the "non-significant" middle range scores.

This variable was important to 36.73 percent of the non-vocational students and to 32.05 percent of the vocational students.



A score of sixty or greater indicates that the student's optimum learning time is late morning.

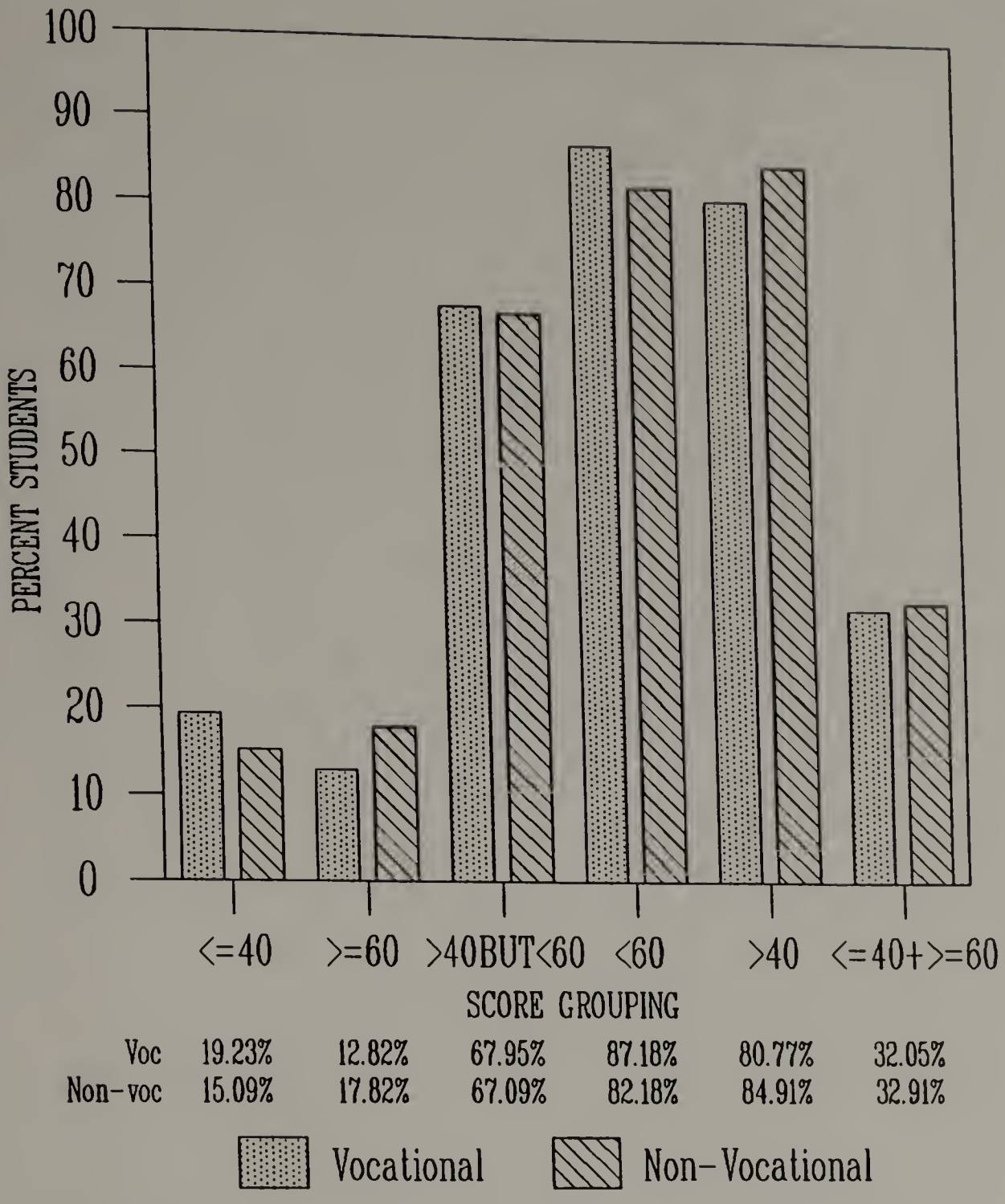
Figure 18. Percent Responses for Subscale 18

Late Morning

Late Morning:

Late morning was a preferred time to do difficult assignments for 18.91 percent of the non-vocational students and for 16.67 percent of the vocational students tested (Figure 18). Late morning was disfavored by 28.21 percent of the vocational group and by 16.73 percent of the non-vocational group. No strong preference was demonstrated by 64.36 percent of non-vocational students and by 55.13 percent of the vocational sample.

When the "non-significant" middle range scores are included, it appears that 83.33 percent of the vocational students could be served by not having difficult assignments in the late morning, while 83.27 percent of the non-vocational students could be served by having such assignments at that time.



A score of sixty or greater demonstrates a preference for learning in the afternoon.

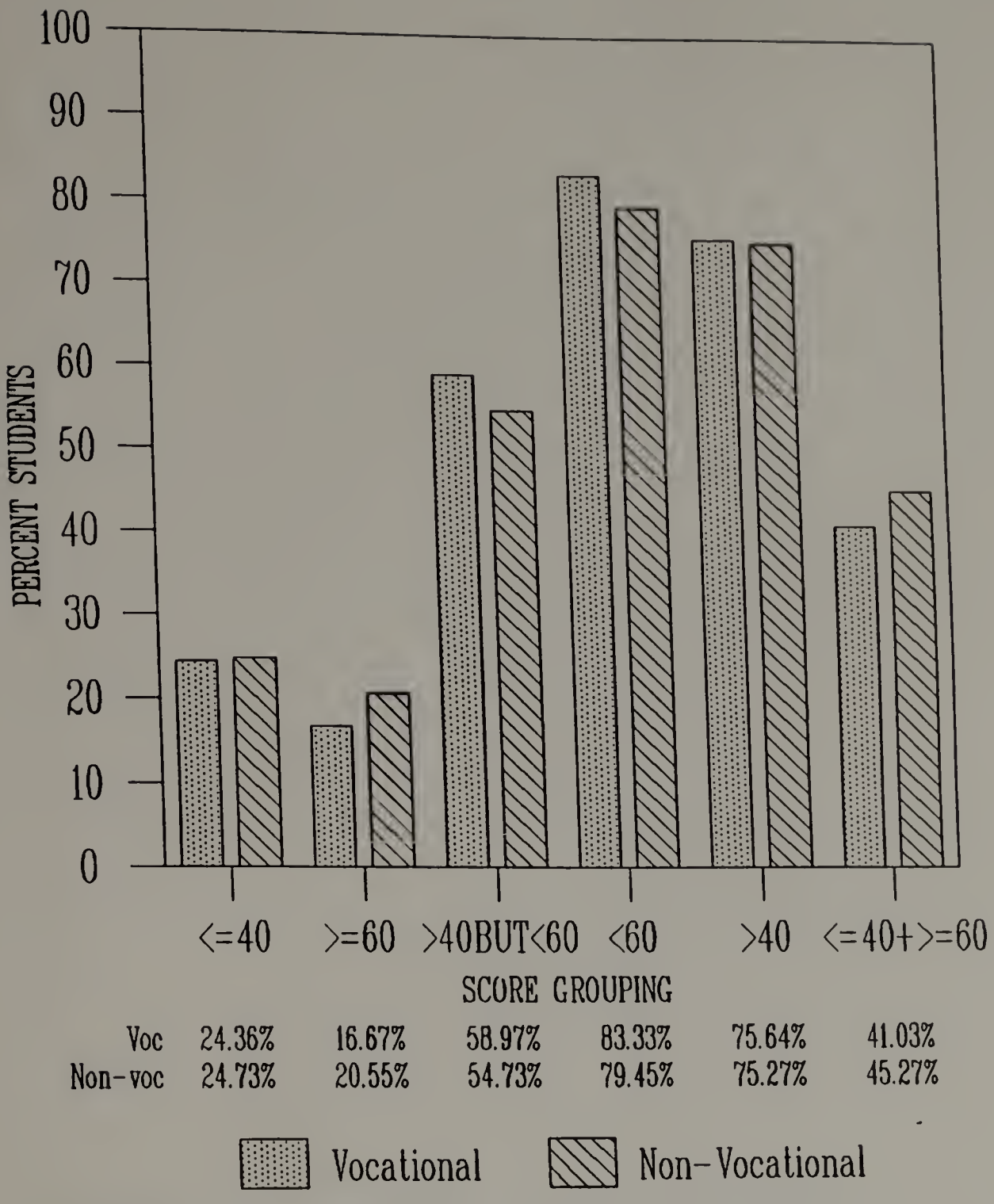
Figure 19. Percent Responses for Subscale 19

Afternoon

Afternoon:

A score of sixty or more on this variable indicates a preference to have difficult assignments in the afternoon. Test scores showed that 17.82 percent of the non-vocational students and 12.82 percent of the vocational students favored afternoon (Figure 19). This time of day was disliked by 19.23 percent of the vocational students and by 15.09 percent of the non-vocational students, who scored forty or less on this variable. Afternoon was not an important variable for 67.95 percent of the vocational students and for 67.09 percent of the non-vocational group.

Inclusion of the "non-significant" middle range scores indicates that 87.18 percent of the vocational students would prefer, or be neutral to, not scheduling difficult assignments in the afternoon, while 84.91 percent of the non-vocational students would prefer, or be neutral to, having such assignments in the afternoon.



A student who scores sixty or more needs mobility to optimize learning.

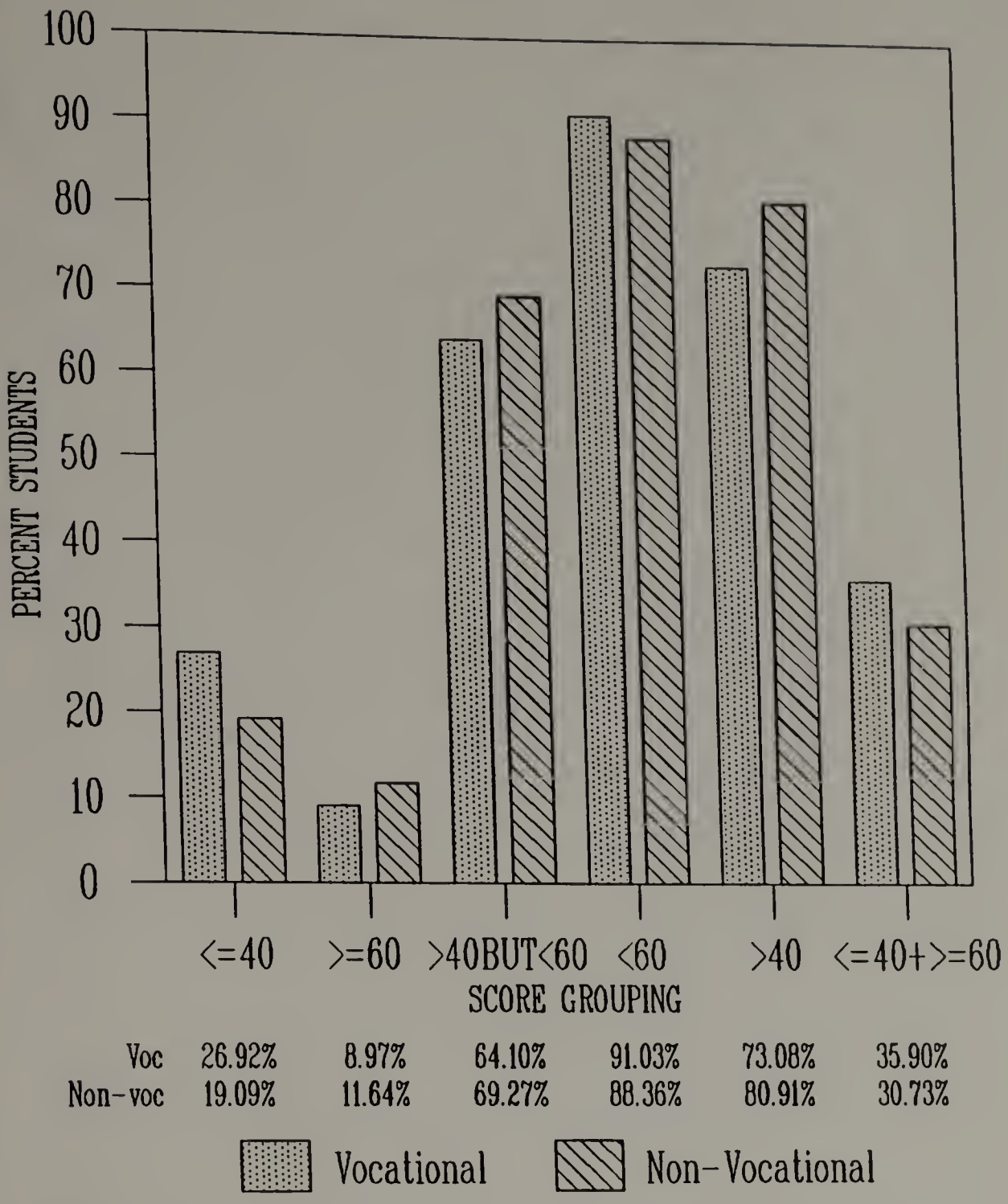
Figure 20. Percent Responses for Subscale 20

Need Mobility

Needs Mobility:

About the same percentage of students in both groups indicated that they did not need to move around in order to complete assignments. The figures were 24.73 percent for non-vocational students and 24.36 percent for vocational students (Figure 20). Scoring sixty or over on this variable, and thereby indicating a need for breaks and movement, were 20.55 percent of the non-vocational students and 16.67 percent of the vocational students tested. The variable was not important to 58.97 percent of the vocational students and to 54.73 percent of the non-vocational students.

In both groups, the most effective method appears to be low mobility. Including those students whose scores were in the "non-significant" middle range and who thereby indicated their indifference to this variable, 83.33 percent of the vocational students and 79.45 percent of the non-vocational students should be able to learn in that environment.



Students who have scored over sixty are motivated by a parent figure.

Figure 21. Percent Responses for Subscale 21

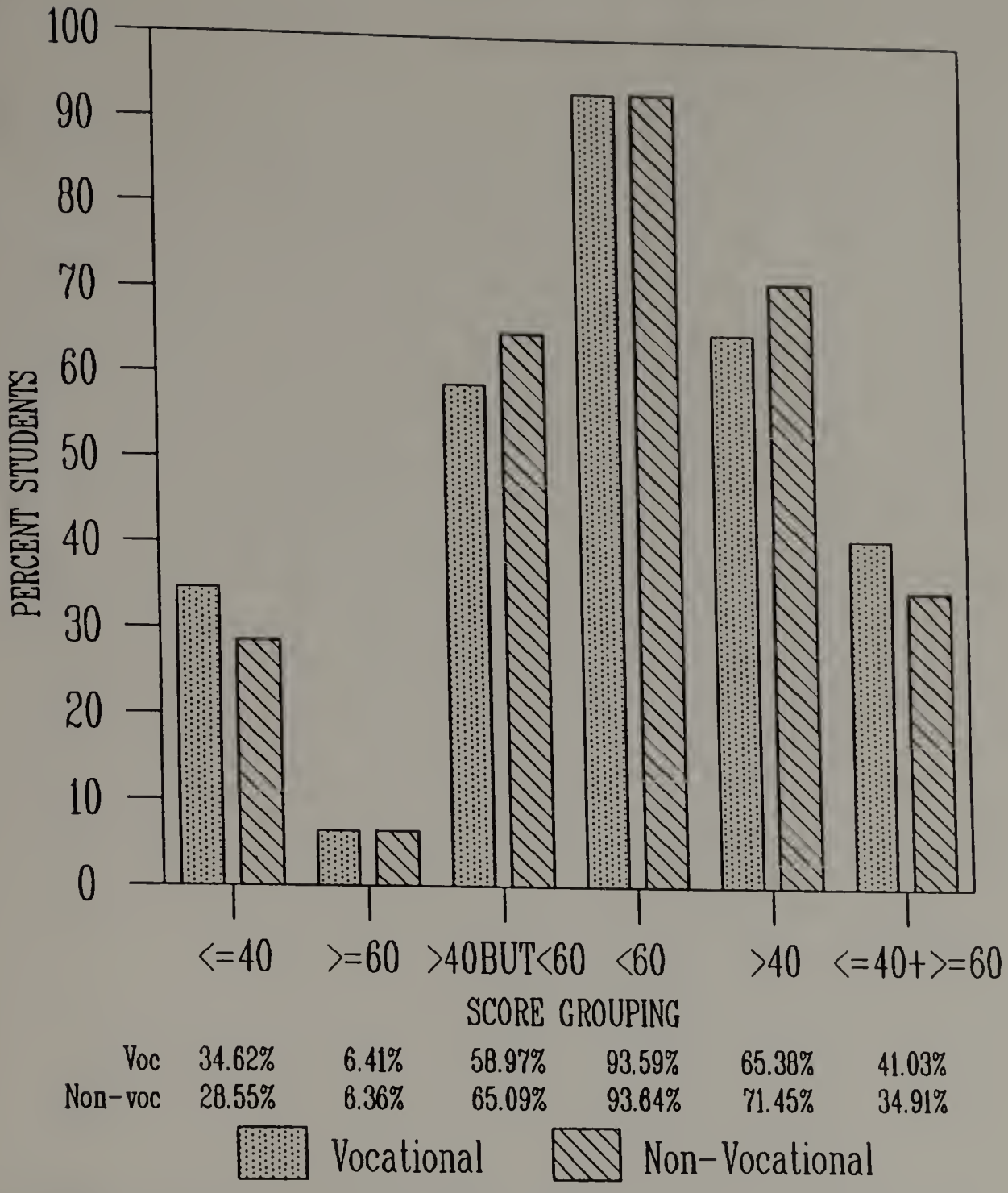
Parent Figure Motivated

Parent Figure Motivated:

The results of the analysis of this variable (Figure 21) indicate that 26.97 percent of the vocational students and 19.09 percent of the non-vocational students tested are not motivated by their parents. Only 8.97 percent of the vocational students and 11.64 percent of the non-vocational students scored sixty or above on this variable, indicating that parental motivation was a strong influence. For these students, frequent teacher contacts with parents are indicated.

Inclusion of the "non-significant" middle range scores suggests that 91.03 percent of vocational students, and 88.36 percent of non-vocational students, could have their needs met without much parent-teacher interaction.

No strong preference was indicated by 69.27 percent of the non-vocational group and by 64.10 percent of the vocational group.



A score of forty or less indicates that teacher motivation is not an important factor, and that the individual is more likely to be end-product oriented than susceptible to teacher motivation.

Figure 22. Percent Responses for Subscale 22

Teacher Motivated

Teacher Motivated:

This variable (Figure 22) measures the importance of teacher motivation of students on learning. A score of forty or less indicates that teacher motivation is not an important factor, and that the individual is more likely to be end-product oriented than susceptible to teacher motivation. Of the vocational students tested, 34.62 percent scored forty or less, indicating that they were not teacher motivated, while 28.55 percent of the non-vocational students scored in that range. A strong preference for teacher motivation was demonstrated by 6.41 percent of the vocational students and by 6.36 percent of the non-vocational students, who scored sixty or above. There was no strong preference indicated for 65.09 percent of the non-vocational students and for 58.97 percent of the vocational group.

The needs of 93.64 percent of non-vocational students and of 93.59 percent of vocational students could be met without much teacher motivation, according to the figures derived from the inclusion of the "non-significant" middle range scores.

SCHOOLS	AVERAGE CONSISTENCY SCORE	PERCENT OF STUDENTS WITH A CONSISTENCY SCORE LESS THAN 70
VOCATIONAL	69.23	15.38%
NON-VOC 1	84.20	4.93%
NON-VOC 2	81.89	4.88%
NON-VOC 3	83.62	8.57%
NON-VOC 4	80.34	2.78%
NON-VOC 5	83.74	10.52%
NON-VOC 6	85.42	8.42%
TOTAL NON-VOC	82.99	6.18%

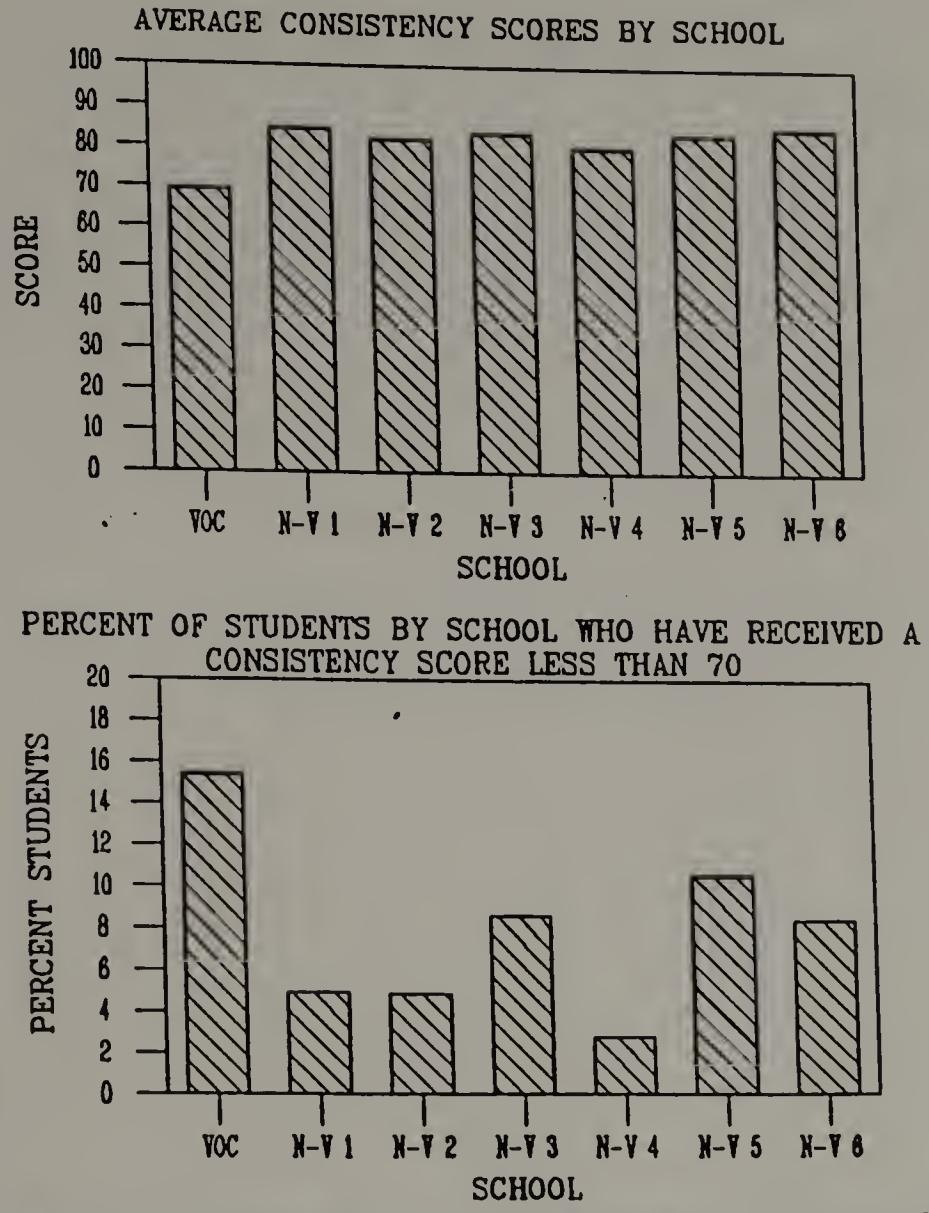


Figure 23. Comparison of Consistency Scores by School

Consistency Scores:

The final graphs (Figure 23) show the consistency scores for the vocational students compared with students at all non-vocational schools tested, and the percentage of students by school who received consistency scores of less than seventy. Consistency is an internal check built into the Learning Style Inventory which ascertains whether or not subjects are responding in a consistent manner to similar questions. On the Learning Style Inventory, a consistency score of seventy or above indicates a consistent level of response. A score of less than seventy raises questions as to the consistency and, consequently, the validity and reliability of that individual's response.

Overall, the non-vocational schools had an average consistency score of 82.99; only 6.18 percent of the non-vocational students sampled were inconsistent in their responses. Franklin County Technical School, by contrast, yielded an average consistency score of 69.23, and 15.38 percent of those students answered inconsistently. The vocational sample was, therefore, borderline in the consistency measurement.

CHAPTER V

SUMMARY

This chapter contains a brief restatement of the problem, research methodology, subject population, instrument, and findings, including a discussion of the implications of the findings and whether the results confirmed or disproved the null hypothesis. Conclusions and observations based on the data are made. Some limitations of the research are discussed. Finally, recommendations for future research are presented.

Discussion

Statement of the Problem

While numerous factors suggest that vocational-technical schools differ in many important ways from comprehensive schools, instructional methods and curricula in the academic areas tend to be the same in both settings. It is reasonable to suppose that there are differences between the students who choose to study in the environment of the vocational school and those who are

content to remain in the "mainstream" of the comprehensive high school. Likewise, one might expect that student learning could be enhanced by the use of methods and curricula that acknowledge such differences, if they exist, rather than denying or ignoring them. This study tested the learning style preferences of vocational students and comprehensive students in order to determine if any significant difference in learning style preference exists between these two groups.

Methodology, subjects, and instrument

The null hypothesis tested stated that the learning style preferences of vocational-technical students are not significantly different from those of comprehensive students. This was tested at the .05 level of significance.

The study design included in its population virtually all ninth grade students attending Franklin County public schools. Seventy-eight vocational students and 550 comprehensive students were tested. In order to correct any possible bias resulting from the overwhelming number of non-vocational as compared to vocational students, the tests of seventy-seven comprehensive students were randomly

selected for analysis. The scores of all seventy-seven of the vocational students who completed the test were used.

The instrument administered to the subject population was the Learning Style Inventory, a paper-and-pencil test developed and validated by Drs. Rita and Kenneth Dunn and Gary Price.(1) Students respond to 104 written questions designed to test twenty-two variables or learning style preferences with responses ranging from "strongly agree" to "strongly disagree."(2)

For each of the variables tested by the LSI, group mean scores for the comprehensive students were compared to those of the vocational students. This analysis provides a descriptive comparison of the two groups for each variable.

A more sophisticated statistical analysis was provided by Dr. Gary E. Price, who performed a stepwise discriminant analysis of the test data. This is a multivariate statistical technique designed by Dr. Price to compare the learning styles of two or more groups. The stepwise discriminant analysis provides a statistically sound statement of significant differences between the groups tested on each variable.

Conclusions

The results of the stepwise discriminant analysis disproved the null hypothesis, as there were twelve variables on which there were significant differences at the .00001 level between comprehensive and vocational students. The variables which significantly differentiated between the two groups were Parent Figure Motivated, Noise Level, Teacher Motivated, Learn in Several Ways, Responsible, Light, Authority Figures, Kinesthetic, Evening-Morning, Late Morning, Tactile, and Temperature. These results are shown at Table 5. As previously stated, the discriminant equation was able to predict accurately 68.8 percent of the time into which of the two groups (vocational and non-vocational) an individual student would fall.

The results from the discriminant analysis indicate that the vocational students differed significantly from the non-vocational group in that they preferred a more quiet environment, low light, and cooler temperature; they were not as conforming or responsible as the comprehensive students; they wanted authority figures present; they disfavored learning in several different ways, including sometimes learning alone, sometimes with peers, and

sometimes with authority figures present; they did not want to learn through their tactile or kinesthetic senses; they preferred to learn in the evening rather than in the early morning or late morning, as did the non-vocational group; and they were less parent motivated and more teacher motivated than their non-vocational counterparts.

The descriptive analysis, a simple comparison of the scores of the two groups on each variable, also shows differences between the vocational and non-vocational students' responses. There is a greater than ten percent difference in responses on the Noise Level, Design, and Late Morning subscales. There is a greater than five percent difference in the the following subscales: Light, Temperature, Motivation, Persistent, Responsible, Learning Alone/Peer Oriented, Learn in Several Ways, Auditory, Visual, Kinesthetic, Requires Intake, Evening-Morning, Afternoon, Parent Figure Motivated, and Teacher Motivated.

It is also noteworthy that, as the figures show, if a teacher were to adapt his instructional methods to the learning style which most of his students either preferred or to which they were indifferent, that methodology would be effective, or at least acceptable, to both vocational and non-vocational students in seventeen of the twenty-two subscale areas. In seventeen of the twenty-two cases the

same teaching methodology would be acceptable teaching in both the vocational and the non-vocational setting. However, this would not be the case in five subscale areas. Those areas are Noise Level, Design, Late Morning, Light, and Temperature. In these areas, a style which would best meet the needs of the most non-vocational students would be least helpful to the vocational students.

Implications

The results of the stepwise discriminant analysis determine only that there is a significant difference between the non-vocational and vocational populations tested. Care must be taken not to read more into the particular variables displaying the differences between the two groups than the data will bear. The results on the variable Parent Figure Motivated, for example, where the most significant difference appeared, are not necessarily a valid indicator of a preferred style for the majority of either group. The discriminant analysis only establishes that significantly more non-vocational than vocational students find that parent figures inspire learning. Compared to the total group, however, the number of non-vocational students favoring the Parent Figure Motivated style was a distinct minority.

The stepwise discriminant analysis results are not a blueprint for teachers, but they do establish the existence of a statistically significant difference in learning style preference between vocational and non-vocational students tested. This difference must be acknowledged and, it is to be hoped, addressed in the classroom. Methods which may be successful in the comprehensive school may be destined for failure in the vocational school due to the learning style of the students. The results of the discriminant analysis demonstrate real differences in learning style preferences in these populations, and support the suggestion that students are self-selecting out of the comprehensive mainstream and into the vocational school perhaps at least in part on the basis of learning style preferences, as the author hypothesized earlier. Dunn and Dunn have long theorized that individuals will self-select environments and opportunities that accommodate their learning style preferences.(3)(4)(5) Whether Franklin County students opt out of the comprehensive high schools because of some instinctive recognition of discomfort arising out of a mismatch of learning and teaching styles, or choose the vocational alternative in the hope of a good match of style preferences, or for other reasons entirely, is beyond the

scope of this study. However, if the choice is based on being different from the population that is content to remain in the comprehensive schools, there are interesting implications for educators that may explain some phenomena subjectively observed and reported by vocational students themselves in the survey cited in earlier chapters: That training for a particular trade is less important than being at the vocational school, or out of the comprehensive school, as shown by frequent changes of shops and a notable tendency among graduates not to work in their shop areas; and that students coming to the vocational school cite the "openness" of the shop situation as a motivating factor in their choice, while simultaneously stating a preference for clearly defined tasks, structure, supervision, and goal-setting.(6)(7) All this suggests that what may be the stereotypical composite of the vocational student as merely a less academic and intellectual, more career- and short-term-goal oriented version of the comprehensive student is wrong, or is not a useful concept. The real differences between the two populations, which the discriminant analysis tells us exist, are not just differences of degree. They are differences in orientation that affect learning. Educators should be sensitive to this fact, particularly in the vocational-technical school, whose

students have chosen the alternative environment. It is possible that the choice represents primarily an escape from an unsatisfactory learning environment.

More specific suggestions as to instructional methods can be derived from the results of the descriptive analysis. The descriptive analysis yields a generalized picture of both groups. Overall, these results indicate that differences exist between vocational and non-vocational students on some variables. Even for variables where no significant difference is shown, the practitioner will find the data useful in adapting his or her teaching style to the preferences of students.

Some suggestions as to what areas should be addressed are outlined in this paper. For example, the vocational students learn best in a quiet environment. Efforts should therefore be made to provide as quiet an environment as possible for these students. Instructors should be sensitive to the fact that, in regard to background noise levels, what best serves the greatest number of the non-vocational students will hinder the efforts of the majority of the vocational group. The same is true of light. The bulk of the vocational group would do well with indirect light, while most non-vocational students would do well in bright, direct light. By contrast, neither group indicated

a preference for structure (that is, a need for specific instructions or explanations prior to completing or undertaking an assignment.) A teacher in either the vocational or a comprehensive school might wish to acknowledge this preference by establishing clearly stated objectives while permitting choices of resources, procedures, timelines, reporting, and checking.(8)(9)

The overall picture of this vocational group which emerges is of students who are less motivated by their parents than are the comprehensive students. This bears out Erickson's conclusion that vocational students "held the family in lower esteem and depended less on relationships with family members" and placed "home life ... relatively low in importance."(10) Thus vocational instructors may not be able to rely on traditional family-school linkages for support. Vocational students, however, are more teacher motivated than their non-vocational counterparts. Not only is the vocational student more susceptible to praise and direct intervention by teachers, but the analysis also showed that vocational students, unlike non-vocational students, liked having an authority figure present in their learning environment whereas the non-vocational students did not. Taken together, these factors suggest that the teacher in the vocational school may be a person of more importance, status, and influence

to students than he or she might think. The instructor seems to replace "natural" authority figures outside the school setting.

In apparent contrast to the fact that they disfavored structure, as did non-vocational students, vocational students want to learn through set patterns of instruction, rather than varying the approach. They would choose a single familiar method, rather than risk experimenting with the learning method. They also showed a low sense of responsibility, indicating that they needed projects with few goals and options, to be accomplished via clearly defined methods and tasks, to the accompaniment of steady, frequent supervision and review. These factors, coupled with the preference for the presence of an authority figure, comport with the typical profile of a learning disabled individual, as Dr. Price remarked in a letter to the author.

The practitioner does not have to settle for a one-method approach to teaching (and to do so would pose the same risk it always does, of alienating and handicapping those individuals who would prefer another method), but should keep this preference in mind, along with the rigidity and timidity at which the preference hints. As suggested earlier, the instructor might introduce

alternative methods in carefully staged, nonthreatening ways, while providing a variety of resources and teaching materials.

In apparent contradiction to the stereotype of the vocational students as one who learns by doing, but in conformity with their rejection of learning in several ways, the vocational students tested disfavored kinesthetic and tactile learning. They rejected these styles more emphatically than did their non-vocational peers. Even keeping in mind the fact that the LSI does not purport to measure career preference, this result seems surprising. Blatently or covertly, underlaying much of vo-tech folklore is the idea that vocational students prefer working with their hands to working with their heads (and its corollary, that vocational students are not particularly good at working with their heads). What these students are telling educators, however, is consistent with their indicated preference for not learning in several ways. It is also consistent with the theory that these students do not choose the vocational school because they are enamored of a particular trade. It does make it more difficult to understand what, if anything, the vocational candidate envisions as the difference between the vocational school and the comprehensive sending school. Perhaps it is more a

measure of these students' desire to escape a disliked environment than a realistic calculation of the potential of the new setting.

Limitations

The possible learning disability factor was not taken into consideration when the testing was done. It is possible that this factor skewed the results and was partially responsible for the difference between the two groups. Another study may wish to match the students within the vocational and non-vocational parameter.

Another area of limitation for this study is found in the consistency scores. As previously stated, only 6.18 percent of the students in the non-vocational schools showed inconsistency in their scores, whereas 15.38 percent of the vocational students showed inconsistency in their answers. This score could be the result of learning disabilities on the part of some subjects or a number of other factors. If this study were to be continued, interviewing the students who showed this inconsistency might be useful to explain this result.

This study is specific to Franklin County . This is in one sense a strength, since there were no sampling problems. Everyone who opted out was present in the test population, as was everyone who chose to stay. Sweeping conclusions concerning the differences between vocational and non-vocational students without further increasing the sample size and sample area should, however, be approached with caution.

Future Study

In future studies, gaining the cooperation of other vocational-technical schools might be an avenue to pursue. This research is specific to the Franklin County Vocational Technical School and the results can not be applied to any other vocational school. In order to have a broader base from which to generalize, a larger number of participating vocational schools is needed. These schools could be tested and the results compared with non-vocational schools. The same applies to the non-vocational schools. The sampling was limited to those in Franklin County, Massachusetts. Consequently, again the results can not be generalized to other schools.

After administering the Learning Style Inventory to a number of vocational schools, it is suggested that provisions be made to apply the results to the individual students. Research could then be conducted to see if this makes any difference in the academic success of these students.

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APPENDIX A
LETTER TO SUPERINTENDENT

Box 63, RFD 1
Orange, Ma. 01364
September 21, 1988

Eileen Perkins
Superintendent of Schools
Mahar Regional School System
Orange, MA. 01364

Dear Miss Perkins,

In addition to my professional position as principal at Mahar Regional School, I am also a doctoral candidate at the University of Massachusetts in the School of Education. It is in this capacity that I am writing this letter to you.

My doctoral dissertation is concerned with the learning styles of students. As you know, there is a considerable amount of research in this area. Determining a student's learning style and adapting teaching techniques, within the capacity of the school, to that style is an effective way to not only increase student academic success but to increase the capacity of the teacher to work with "difficult" students. The research appears to show that students who attend vocational-technical schools have a different learning style than students attending comprehensive high schools. I am interested in testing this hypothesis. I would like to administer the Learning Style Inventory developed by Doctors Rita and Kenneth Dunn and Dr. G. Price to all of the ninth graders in the Franklin County Schools.

The Learning Style Inventory is based on a factor analysis of 22 areas comprised of 104 questions. Students respond on a five point Liekert scale ranging from strongly agree to strongly disagree. Students are asked to answer quickly with their first response. The average time to administer the test is between thirty and forty minutes. Factors i.e. preference for noise level, light, temperature, kinesthetic learning will be analyzed for each student. The results will be computer scored and five printouts of the results for each student will be returned to the test administrator. These results, for individual students, will be returned to the Guidance Department in your school.

I am interested in the general trend of each school and will be analyzing the results to obtain a comparison between vocational-technical and comprehensive schools. All results of this testing

will be made available to each school and I am willing to answer any questions as to how each school can best utilize these results.

I am requesting your permission to have your school participate in this study. I am availabe to answer any additional questions that you might have concerning either the testing procedure or the results of the test. I will telephone you in a few days, so that I might personally answer any questions. Thank you for your considerationa of this request and I look forward to speaking with you personally.

Sincerely,

Francis W. Zak

APPENDIX B
LETTER TO PARENT

Box 63, RFD 1
Orange, Ma. 01364
October 1988

Dear Parent,

On October , we will be administering the Learning Style Inventory to your child. This inventory was developed by Doctors Rita and Kenneth Dunn and Dr. G. Price to test differences in learning styles among children. As you know, not all children learn in the same ways. Some are more sensitive to noise, some to light, etc. This inventory analyzes 22 of these factors and determines the way your child learns best. The test takes approximately 40 minutes to administer.

The test is being administered to all ninth graders in Franklin County. The results, of this testing, will be used by each school to more adequately meet the educational needs of your child. If you do not want your child to participate in this testing or if you have any further questions, please call the Guidance Counselor at your school. You may also call Francis Zak, Principal - Mahar Regional School System (508) 544-2542.

Thank you for your cooperation.

Sincerely,

Francis W. Zak

APPENDIX C

INSTRUCTIONS FOR ADMINISTERING THE LEARNING STYLE INVENTORY

USE ONLY #2 PENCILS

Instructions to students:
Only ninth graders are being asked to take this inventory. If you are in any other grade, please return to your class. Turn the paper horizontally so the pencil design is on the left hand side facing down. Fill in your last name in the top left hand squares, one letter per box. Fill in the corresponding circles underneath each letter.

Fill in the mark corresponding to male or female and the year and month of your birth. Put one number per column. Please place a "0" in the first column under month, if your month has only one number i.e. January would be "01". You will be given an identification number for your school. Fill in this number in the appropriate box.

Turn the paper so that you can read the questions. With this test there are no right or wrong answers.. We want to know under what circumstances you feel you do your best studying and learning. The responses range from strongly agree to strongly disagree. Because of the nature of the test, you are asked to give only your immediate response and to not erase. You will have thirty minutes to complete both sides of the answer sheet. Remember to turn your answer sheet over when you have finished the first side. Because of the nature of this test, you are asked to go with your first response to a question rather than erasing. All circles must be filled in completely and marks must be dark. Remember, there are no right or wrong answers.

Notes to test administrators:
Make sure students use only the pencils provided with this test. Please emphasize to students that this is a type of test that emphasizes feelings rather than knowledge, therefore, there are no right or wrong answers. Emphasize that the circles must be filled in darkly and that it is preferable not to erase.

Identification Numbers:
Franklin County Tech #1
Frontier #2
Greenfield #3
Mahar Regional #4
Mohawk #5
Pioneer #6
Turners Falls #7

APPENDIX D

COMPARISON OF VOCATIONAL AND NON-VOCATIONAL 9TH GRADE STUDENTS ON THE LEARNING STYLE INVENTORY USING A DISCRRIMINANT ANALYSIS

Description: A Discriminant Analysis is designed to compare two or more groups and their Learning Style Variables. The way this is done is the variable which accounts for the most significant difference between the groups goes into the discriminant equation first. Then the next variable which accounts for unique additional variance then goes into the discriminant equation. Variables continue to enter the discriminant equation until no additional significant variables are found which significantly discriminate between the groups.

A total of twelve (12) out of twenty-two (22) variables significantly discriminated between the two groups. There was 77 in the vocational group and 77 in the non-vocational group. Overall, the discriminant equation was able to predict accurately 68.8% of the time which of the two groups of vocational and non-vocational groups the students would fit into using the weighted scores on the twelve variables.

The first variable to enter the discriminant equation was Parent Figure Motivated. Overall, the non-vocational students were more Parent Figure Motivated then were the vocational students. This meant they wanted to learn because their parents would like them to.

The second variable to enter the discriminant equation was Noise Level. Overall, the non-vocational students wanted sound present more than the vocational students.

The third variable to enter the discriminant equation was Teacher Motivated. The vocational students wanted to learn more

because their teachers wanted them to than did the non-vocational students. I want to point out that there's a slight mean difference but the way the discriminant analysis works, is after the previous two variables, in this case, have been taken out of the equation, the Teacher Motivated variable accounted for a unique portion of the variance.

The fourth variable to enter the discriminant equation was Learn in Several Ways. Overall, the non-vocational students prefer to learn more in several ways more than the vocational students.

The fifth variable to enter the discriminant equation was Responsible (or Conforming). Overall, the non-vocational students were more responsible. In other words, they would do things if someone asked them to quicker than the vocational students.

The sixth variable to enter the discriminant equation was Light. The non-vocational students wanted bright light more than the vocational students.

The seventh variable to enter the discriminant equation was Authority Figures Present. Overall, the vocational students like to have an authority figure present more than the non-vocational students.

The eighth variable to enter the discriminant equation was Kinesthetic. The non-vocational students indicated that they wanted to learn more through their kinesthetic sense than did the vocational students.

The ninth variable to enter the discriminant equation was Evening and Morning. Overall, the vocational students indicated

that they wanted to learn more in the evening and the non-vocational students indicated that they prefer to learn more in early morning.

The tenth variable to enter the discriminant equation was Late Morning. Overall, the non-vocational students indicated that they wanted to learn more in the late morning than did the vocational students.

The eleventh variable to enter the discriminant equation was Tactile. Overall, the non-vocational students indicated that they were slightly more tactile than were the students in the vocational area.

The 12th variable to enter the discriminant equation was Temperature. Overall, the students in the non-vocational program preferred a warmer environment than did the students in the vocational program.

Thus, a total of twelve variables significantly discriminated between the two groups at the .00001 level. There was one discriminant function. See the enclosed printout and table with the mean differences. The vocational students wanted more of a quiet environment, they wanted low light, they wanted cooler temperature, they were not as conforming or responsible, they wanted authority figures present, they did not like to learn as much in several ways, which means sometimes learning alone, sometimes with others, sometimes with authority figures present, they did not want to learn through their tactile or kinesthetic sense, they wanted to learn more in the evening and not in the early morning or late morning and they were less parent figure

motivated and more teacher motivated than were the non-vocational students.

Enclosed is the printout. You might want to talk with your statistical consultant if you want to interpret any more of the data on it.

(Letter from Gary E. Price February, 1989, summarizing the Discriminant Analysis of data comparing vocational and non vocational schools)

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